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ROYAL BOTANIC GARDENS, KEW

LI.—CANTHIUM IN BRITISH EAST AFRICA.

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Introduction.

Dr. Robyns's excellent monograph of the tribe Vanguerieae* has rendered that tribe of Rubiaceae one of the easiest of the family to deal with in the herbarium, with the exception of the genus *Canthium* Lam., the study of which Dr. Robyns deferred. At Mr. J. Hutchinson's suggestion the writer has attempted to arrange systematically the East African species of this difficult genus; the present arrangement, however, is to be regarded as purely tentative, the material available for study being in many cases incomplete or too scanty to give any idea of the range of specific variation. British East Africa as here understood includes the Uganda Protectorate, Kenya Colony, and the Mandated Territory of Tanganyika.

In addition to the material in the Kew Herbarium, where the benefit of Mr. Hutchinson's advice and criticism has always been obtainable, the writer is indebted to the authorities at the British Museum (Natural History) for facilities for study in the herbarium there, to Dr. Diels for the loan of much type and other material from the Berlin Herbarium, and to Dr. Burtt Davy for the loan of material from the herbarium of the Imperial Forestry Institute, Oxford.

A relatively large number of new combinations has been found necessary owing to the persistent use by some authors of the Linnean name *Plectronia* for the genus. The reasons for abandoning this name are here restated. Some hitherto undescribed species are also included, some of which it has been necessary to describe from rather poor or incomplete material. The key is more or less descriptive, and the characters mentioned are contrasted as far as possible; it is therefore necessary to read each pair of contrasted portions completely, and not to rely too much on the opening phrase. The drawings are the work of Miss S. Ross-Craig, to whom the author is much indebted.

Except where otherwise stated, all the specimens cited have been examined, and those not to be seen at Kew are followed by the following abbreviations indicating the herbarium in which they are contained:—

Ber.=Berlin.
B.M.=British Museum (Natural History).
Oxf.=Oxford (Imperial Forestry Institute).
Am.=Amani (Tanganyika).

* Robyns in Bull. Jard. Bot. Brux. xi. fasc. 1 (1928).

History and Nomenclature.

The genus *Plectronia* was founded by Linnaeus[1] on a specimen preserved in the Linnean herbarium and on a figure published by Burmann[2] as "*Rhamnus* foliis subrotundo-acuminatis, fructu racemoso." The association of this figure with the Linnean specimen under *Plectronia* was unfortunate, since the specimen and figure are referable to two widely separated families, Oliniaceae and Rubiaceae respectively.

It is not clear whether Thunberg[3] was aware of this discrepancy when he described his genus *Olinia* (*O. cymosa*), but there is not the least doubt that it is identical with Linnaeus' specimen of *Plectronia*. To obviate nomenclatural difficulties in this case Sprague[4] has proposed the conservation of *Olinia* Thunb. against *Plectronia* Linn. There remains, however, the difficulty presented by Linnaeus' citation of Burmann's figure under the name *Plectronia*.

Lamarck[5] in 1795 described the genus *Canthium*, and Burmann's figure (2) is, in the opinion of most modern authors, referable to it. De Candolle[6], neglecting the Linnaean specimen, referred both *Plectronia* and *Canthium* to the Rubiaceae, and maintained both genera, in addition to *Phallaria*, a genus established by Schumacher[7] to accommodate two West African species, but afterwards reduced to *Canthium* by A. Richard[8]. Bentham and Hooker[9], and also Schumann[10], regarded *Plectronia* and *Canthium* as synonymous, and these authors therefore used the older Linnean name. In 1898, however, Hiern[11] and later Robyns[12] pointed out that the synonymy was not complete.* It appears, in fact, that the name *Plectronia* as applied to Burmann's figure, and hence to the Rubiaceae, is based on a wrong identification. The earliest legitimate name for the plant represented by Burmann's figure is therefore *Canthium* Lam. The synonymy given below (p. 358) is not by any means complete for the genus as a whole, but it includes all the more important references, which lead to any further information required by future workers.

As regards the species, nomenclatural difficulties are rarely encountered. In this revision only one new name (*C. euryoides* Bullock) is proposed in place of an earlier illegitimate name (*C.*

[1]Linn. Mant. 6 (1767).
[2]Burm. Pl. Afr. 257, t. 94 (1739).
[3]Thunb. in Roem. Arch. ii. 4 (1799).
[4]Sprague in Prop. Brit. Bot. 85 (1929).
[5]Lam. Encycl. i. 602 (1795).
[6]DC. Prodr. iv. 619 (1830).
[7]Schum. et Thonn. Pl. Guin. 112 (1827).
[8]A. Rich. Tent. Fl. Abyss. i. 350 (1847).
[9]Benth. et Hook. f. Gen. Pl. ii. 110 (1873).
[10]K. Schum. in Engl. et Prantl, Nat. Pflanzenfam. iv. Abt. 4, 91 (1897).
[11]Hiern, Cat. Welw. Afr. Pl. i. 472 (1898).
[12]Robyns in Bull. Jard. Bot. Brux. xi. fasc. I. 7 (1928).

* Without any discussion Hiern had previously used the name *Canthium* for this genus in the Flora of Tropical Africa, iii. 132 (1877).

nitens Hiern), and one new name for a species transferred from *Plectronia* to *Canthium*, on account of preoccupation of the specific epithet (*P. lamprophylla* K. Schum. becomes *C. micans* Bullock). This is, of course, due to the fact that most of the African species have been described since the publication of the Index Kewensis and of the third volume of the Flora of Tropical Africa, and have a very short nomenclatural history.

Value of Characters.

The genus, as represented in East Africa, includes several highly critical small groups of species, but in general the specific limits are fairly readily discernible. Four primary series are tentatively suggested, though further subdivision, especially of the *Pedunculate Series*, will be necessary.

The *Pedunculate Series*, including 30 species, is characterised by a cymosely branched inflorescence, the typical form being shown in figure 1, illustrating *C. venosum*. This becomes variously modified in other species, an extreme case being *C. Robynsianum* (figure 2). In *C. bibracteatum* the cyme branches once only (or not at all), the two arms terminating in many-flowered false umbels, while in *C. subopacum* the inflorescence is branched from the extreme base, a fact which led Schumann and Krause to describe the flowers as fasciculate. Although the pentamery or tetramery of the flowers of this series proves useful,* it was found that a more natural arrangement was made possible by first separating all the very hairy species from those which have almost or quite glabrous stems and leaves. In the latter it is usually found that the inflorescence branches are finely puberulous, as for example in *C. vulgare* and *C. rubrocostatum*. In general, the hirsute species are scrambling plants, the branchlets being inserted at right angles to the main stem, while the glabrous species are usually erect shrubs or trees. Exceptions are the fairly common *C. zanzibaricum*, which is sometimes rather densely pubescent in the young stage, but rapidly becomes glabrous, and the less common but widely distributed *C. venosum*, which sometimes retains its indumentum, especially on the branches, even when mature. The indumentum of various groups of species is very characteristic. In the *C. Gueinzii* group, for instance, the stems are very densely hairy, the indumentum in some cases being shortly tomentellous with an admixture of long, more or less stiff, setose hairs, the latter being exclusively present on the lower surface of the leaves and especially on the inflorescence branches. In the *C. vulgare* group, on the other hand, the stems and leaves are, as a rule, perfectly glabrous and the inflorescence branches are finely puberulous ; this group includes only trees and erect shrubs with ascending branchlets.

* Some species are included of which flowers have not been seen ; in several cases the remains of the calyx in the fruiting stage has given the necessary information, and in a few the position of the species has been inferred from its general affinities.

The mode of growth of the erect species shows two interesting forms. *C. vulgare* and its allies produce elongated shoots with several pairs of leaves, the stipules being early deciduous, leaving only a faint scar; whereas *C. crassum*, *C. Siebenlistii* and their allies produce but one pair of leaves each season, the stipules are very persistent, become woody, and the internodes are often much abbreviated. The extreme case of this last condition is seen in *C. pseudoverticillatum* where the leaves appear to be in whorls of four owing to the extreme shortness of the opposite branchlets. *C. Robynsianum* also produces very short internodes, but one of the axillary buds in each pair of leaves is usually dormant. In a few cases specific limits are ill-defined, especially in the *C. Gueinzii* alliance. The species overlap both in characters and distribution, and it seems certain that hybridisation has taken place.

Leaf-shapes, excepting apical and basal characters, although usually mentioned, have not been used to any great extent in differentiating species. This is not on account of pronounced variability, nor even because most of the species produce similar leaves; shape and texture are in fact highly specific characters, but the personal factor encountered when describing them renders their use confusing, and it was not considered advisable to depend upon them.

As a rule, reduction in the number of flowers in each cyme, as in *C. captum* compared with *C. Gueinzii*, is accompanied by the development of stouter, shorter pedicels, and a further corresponding development is seen in the production of fewer, much larger fruits. The case of *C. Robynsianum* is an exception. Here, as shown in figure 2, the cymes are reduced to about three small flowers, but the pedicels have remained extremely slender.

The modified cymes found in *C. bibracteatum* and *C. subopacum* (see above, p. 355) provide interesting connections with the *Anomalous* and *Fasciculate Series* respectively. Both are rather anomalous members of the group in which they are placed here; and in general appearance *C. subopacum* more strongly resembles some of the *Fasciculate Series* than any other species, while the resemblance between *C. bibracteatum* and the *Anomalous Series* is also most marked.

The main types of flower structure met with in the genus are illustrated in figures 1–4. The flower characters are not of great value in specific differentiation, but *C. Kaessneri* can be separated easily on account of its large corolla. The *Spinose* and *Anamolous Series* have very small flowers, but otherwise variation in size is not marked. The shape of the stigma and anthers is of serial value.

Ecological Distribution and Growth Form.

The *Spinose Series*, represented here by *C. glaucum*, includes spiny shrubs or trees of the coastal and fringing forests. *C. glaucum* itself has been collected only near the coast in Kenya Colony, but its

more southern counterpart, *C. Frangula*,* occurs far inland on the banks of the Zambesi.

The *Anomalous Series*, comprising erect trees and shrubs, is also entirely eastern in range, and constitutes an endemic group confined to the littoral and sublittoral regions, penetrating inland only where the soil is exceptionally saline. Its species are somewhat anomalous in the genus, with characteristic coriaceous leaves and large membranous stipules. They are linked taxonomically with the *Pedunculate Series* by *C. bibracteatum*, which is a shrub or small tree of similar habit, confined on the mainland to the eastern littoral, but extending through Zanzibar and Pemba to the more distant Mascarene Islands; it is the only species considered here which extends farther from the mainland than Zanzibar and Pemba.

The *Fasciculate Series* includes, in the main, trees and erect shrubs of the subtropical rain forests, though several of the group occur in the tropical rain forests of West Africa, and some, such as *C. recurvifolium*, are littoral thorn-scrub shrubs. *C. euryoides* is found westwards to the Niger river as well as in East Africa, and *C. Kaessneri* is known from only three localities—one in Kenya Colony, one in Tanganyika and one in Portuguese East Africa.

The most interesting but at the same time most complex group is undoubtedly the *Pedunculate Series*, which for distribution purposes may be split up into three main groups which are also fairly distinct taxonomically. They will be referred to as shown in the "key" below, and though such a classification is naturally imperfect, the great majority of the species concerned fit into it very well.

Erect glabrous trees and shrubs :
Branchlets elongated, with several pairs of leaves..... *C. vulgare* group.
Branchlets short, with only one pair of leaves..... *C. lactescens* group.
Scrambling (or sometimes erect) coarsely hairy shrubs with elongated branchlets inserted at right angles...*C. Gueinzii* group.

The *C. vulgare* group are typically trees or erect shrubs of the rain forest areas, some of which produce good timber.

Trees and shrubs of quite different aspect are included in the *C. lactescens* group. These are plants of the fire-swept open woodlands and deciduous (*Brachystegia*) forests. They frequently develop a thick bark which serves as a protection against fire. Each branchlet produces only one pair of leaves each season, and the internodes are often much abbreviated.

The last group is the most complex of all, and contains the most numerous apparent contradictions. The species seem to be to a great extent independent of environmental conditions, and produce different habit forms to suit the particular conditions to which they are exposed. Typically, however, they are scrambling shrubs of the

* See note in enumeration under *C. glaucum* Hiern.

rain and fringing forests, but some of them at least thrive also as erect shrubs of the open woodlands and deciduous forest lands. They appear to be deciduous or evergreen according to the type of country in which they occur, and correlated with this great flexibility their geographical range is equally extensive. *C. Gueinzii* itself is the most widely distributed species in Africa, while *C. zanzibaricum*, *C. venosum*, *C. sylvaticum* and *C. scabrosum* have also very extensive geographical ranges.

CANTHIUM *Lam.*

Lam. Encycl. i. 602 (1785)* ; DC. Prodr. iv. 473 (1830) ; A. Rich. Tent. Fl. Abyss. i. 350 (1847) ; Hiern in Oliv. Fl. Trop. Afr. iii. 132 (1877), et Cat. Welw. Afr. Pl. i. 472 (1898) ; Baill. Adans. xii. 179 (1878), partim ; Robyns in Bull. Jard. Bot. Brux. xi. fasc. 1. (1928), in clavi et obs. ; Hutch. et J.M. Dalz. Fl. W. Trop. Afr. ii. 112 (1931).

Phallaria Schum. in Schum. et Thonn. Beskr. Guin. Pl. 112 (1827) ; DC. Prodr. iv. 619 (1830).

Plectronia DC. Prodr. iv. 475 (1830) ; Benth. et Hook. f. Gen. Pl. ii. 110 (1873) ; K. Schum. in Engl. et Prantl, Nat. Pflanzenfam. iv. Abt. 4, 91 (1897), et in Engl. Hochgebergsfl. Trop. Afr. 399 (1892), et in Engl. Pflanzenw. Ost-Afr. C. 385 (1895) ; non Linn. Mant. 6. (1767), nec Lour. Fl. Cochinch. 162 (1790).

Keetia Phillips, Gen. S. Afr. Fl. Pl. 587 (1926), et in Bothalia, ii. 368 (1927).

Calyx : tube (i.e. the portion adnate to the inferior ovary) short, obconic, turbinate, hemispherical or globose ; limb very short, cupular or annular, truncate or 4–5-dentate, usually persistent. *Corolla* : tube short, cylindrical or broadly funnel-shaped, villous at the throat, glabrous outside ; limb 4–5-lobed, lobes valvate, erect, spreading or reflexed, as long as or longer than the tube, rarely shorter, oblong or triangular, acute or subacute, glabrous outside or sometimes strigose-pilose towards the apex. *Stamens* 4–5, inserted at or just below the throat of the corolla ; filaments very short, filiform, or almost obsolete ; anthers dorso-basifixed, oblong, obtuse or very obscurely mucronate. *Disk* annular, fleshy. *Ovary* invariably 2-locular ; style usually exserted, or sometimes scarcely as long as the corolla-tube, often more than twice as long as the corolla-tube ; stigma capitate, mitriform or subglobose, truncate at the base and apex, or somewhat deeply bilobed, often sulcate. *Ovules* solitary, anatropous, pendulous. *Drupes* didymous or by abortion one-celled ; cells globose or ellipsoid.—*Shrubs* or *trees*, armed or unarmed, often scandent, with terete or square branchlets. *Leaves* opposite, chartaceous or coriaceous, shortly petiolate. *Stipules* interpetiolar, triangular, acuminate or long-cuspidate, or ovate-lanceolate and acute, persistent or often early deciduous.

* For dates of publication of the parts of this work see Journ. Bot. xliv. 318 (1906).

Flowers axillary in pedunculate corymbose cymes, often modified, or in sessile fascicles, or rarely solitary, white, cream or greenish. *Fruits* small or rarely attaining 3 cm. or more in diameter, woody or fleshy.

KEY TO SERIES.*

Shrubs or trees armed with supra-axillary spines..... I. *Spinose Series* (p. 359).

Shrubs or trees without spines :

Inflorescence a pedunculate or sessile cyme (sometimes much modified) ; corolla-lobes usually spreading or reflexed (erect in *C. Robynsianum, C. telidosma* and *C. microdon*)..... II. *Pedunculate Series* (p. 360).

Inflorescence a sessile fascicle, or flowers solitary :

Corolla-lobes spreading or reflexed ; stigma longer than its diameter, deeply 2-cleft ; stipules more or less coriaceous (margins often membranous) usually subulate or long acuminate from a broad triangular base..... III. *Fasciculate Series* (p. 381).

Corolla-lobes erect ; stigma subglobose, entire ; stipules membranous, ovate or lanceolate, subacute or acute, but not subulate or long acuminate as above..... IV. *Anomalous Series* (p. 386).

I.—SPINOSE SERIES.

Small glabrous forest tree armed with supra-axillary spines about 1 cm. long ; leaves produced in single pairs on the very short lateral shoots, elliptic, 2–2·5 cm. long and about 1·5 cm. broad, apex obtuse or subacute, rounded to cuneate at the base, thinly herbaceous ; flowers in shortly-pedunculate false umbels ; peduncle 5 mm. long ; pedicels 6–8 mm. long ; calyx deeply 5-dentate ; corolla apiculate, 2·5 mm. long in bud..... 1. *C. glaucum.*

1. **Canthium glaucum** *Hiern* in Oliv. Fl. Trop. Afr. iii. 134 (1877), partim, quoad specim. keniense.—*Plectronia glauca* K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 386 (1895), quoad specim. keniense.

KENYA COLONY. "Somali Coast ; Sola River," April, *Kirk s.n.* (type). Arabuko, Malindi District, a small somewhat scandent forest tree up to 20 ft. high, with greenish flowers, March, *Graham 2352.*

It is many years since Hutchinson recorded in a manuscript note in the Kew Herbarium the fact that Kirk's Zambesi-land specimen

* Since only a portion of the genus is under consideration the series employed here are not intended to have any nomenclatural value, and Latin names are not, therefore, applied to them. The *Spinose Series*, it may be noted, corresponds with Schumann's section *Armatae*, but the others are not paralleled in any other classification.

collected at Tette, and cited by Hiern under this name, is not conspecific. *C. glaucum* had not been collected since the first specimen was sent to Kew until Mr. Graham's excellent material was received in 1930, and this leaves no doubt that the Zambesi specimen belongs to a distinct though closely allied species. I have been unable to trace the exact location of the Sola River, but it seems likely that it is included in the Malindi District. The Zambesi plant is identical with *C. Frangula* S. Moore, described in the account of Mr. C. F. M. Swynnerton's Gazaland plants in the Journal of the Linnean Society (Botany), vol. xl. p. 89 (1911).

II.—Pedunculate Series.

*Peduncle more or less well developed, always readily distinguishable (very short and filiform in *C. Robynsianum*).

†Branchlets elongated, always with many pairs of leaves (except *C. indutum*) more less densely pubescent, setose, woolly tomentose or tomentellous, or if only slightly pubescent, then flowers 4-merous :

Leaves shortly and densely tomentose below and/or branchlets densely woolly tomentose (see below).....30. *C. crassum*

Leaves never tomentose below ; branchlets at most shortly tomentellous, never woolly :

Corolla-lobes strigulose-pilose outside :

Cymes 1–2-flowered ; ovary very densely golden-pubescent, globose ; leaves ovate to ovate-lanceolate or elliptic, apex obtuse or subacute, rounded at the base, about 2–4 cm. long and 1–2 cm. broad, thinly hispidulous above, more densely so below, especially on the nerves (see also in the *Fasciculate Series* below) 2. *C. telidosma*

Cymes 3- or more-flowered ; ovary thinly pubescent, minute ; leaves very much as above, but smaller, glabrous above except on the midrib, and very thinly hispidulous below.....3. *C. microdon*

Corolla-lobes glabrous outside :

‡Leaves pubescent or hispidulous all over the upper surface :

Leaves long-attenuate or acute at the base, apex rounded, oblanceolate to oblong or oblong-elliptic, about 6 cm. long and 1·5–3 cm. broad, hispidulous above and below, minutely scabrescent above ; flowers in very shortly-pedunculate glomerulate cymes ; calyx subacutely 5-dentate ; corolla rounded in bud, 4 mm. long ; branchlets hispidulous, bark greyish-brown.....4. *C. sordidum*

Leaves acute at the base, acute or acuminate at the apex (see below).....13. *C. huillense.*

Leaves rounded to subcordate at the base, apex obtuse to acuminate :

Branchlets rather thinly spreading-setose (see below) 9. *C. hispidum*

Branchlets densely tomentellous :

Leaves elliptic or broadly oblong-elliptic, apex obtuse, rounded at the base, 4–6·5 cm. long, 2·5–4 cm. broad, velvety-pubescent, especially on the midrib and 3–5 pairs of lateral nerves below, drying bluish-black ; petioles 5–8 mm. long ; branchlets short, developing only one pair of leaves each growth-season ; bark very light greyish-brown, powdery.....5. *C. indutum*

Leaves lanceolate to oblong, acutely acuminate, subcordate at the base, 6–11 cm. long, 2·5–5 cm. (or more) broad, long-pubescent especially on the midrib and 7–9 pairs of lateral nerves below, scabrescent above, drying greenish-brown ; petioles 2–4 mm. long ; branchlets elongated with several pairs of leaves ; bark dark brown, smooth.....6. *C. scabrosum*

‡‡Leaves glabrous above or adpressed-pubescent only on the midrib and lateral nerves (rarely a few scattered setae present) :

§Branchlets tomentellous with sometimes a few spreading setae also present ; leaf-margins not ciliate :

Leaves rounded, not cordate at the base, oblong-elliptic to ovate or obovate, abruptly narrowed to the broadly rounded apex, minutely mucronulate, 5–6·5 cm. long and up to 4 cm. broad, glabrous above, pubescent below, the midrib and 5–6 pairs of lateral nerves densely tomentellous, sometimes becoming almost glabrous in age, tertiary veins not impressed above ; petioles tomentose ; calyx tomentose, with 5 triangular teeth.....7. *C. purpurascens*

Leaves distinctly cordate at the base, oblong or rather broadly oblong-lanceolate, acutely and rather gradually acuminate, up to 10 cm. long and 4 cm. broad, adpressed pubescent on the midrib and 6–8 pairs of lateral nerves above, tertiary veins impressed, hispidulous below, especially on the nerves ; petioles hispid ; calyx triangular-5-dentate, setose-pubescent, but less densely so than the slender pedicels.....8. *C. Gueinzii*

Leaves rounded to subacute at the base, apex abruptly acuminate, rather thinly adpressed or

spreading pubescent on the nerves below (see below).....11. *C. sylvaticum*

§§Branchlets persistently thinly spreading long-setose ; leaves oblong to narrowly oblong-ovate, acutely acuminate, subcordate at the base, up to 14 cm. long and 5 cm. broad, thinly setose-pubescent below, especially on the midrib and 6–8 pairs of lateral nerves and sometimes with a few scattered setae above, margins thinly ciliate, tertiary veins not impressed above ..... 9. *C. hispidum.*

§§§Branchlets adpressed pubescent or puberulous, more or less glabrescent (very glabrescent in *C. charadrophilum*) ; leaves acute to rounded at the base :

Drupes comparatively small, the cells not exceeding 8 mm. diam., fairly numerous in each infructescence :

Leaves markedly parallel-venose above (see below) 14. *C. venosum*

Leaves not as above, tertiary veins rarely visible above :

Calyx rather deeply and acutely triangular-dentate ; inflorescence-branches long-pubescent ; scrambling shrubs with the branchlets inserted at right-angles ; leaves narrowly oblong to oblong-elliptic :

Inflorescence lax, multiflorous ; branchlets rather thinly pubescent, glabrescent ; leaves up to 10 cm. long and 3·5 cm. broad ; internodes very long, up to 6 cm. long..... 10. *C. charadrophilum*

Inflorescence rather congested ; branchlets rather densely pubescent ; leaves about 7–9 cm. long and up to 4 cm. broad ; internodes about 2–3 cm. long...11. *C. sylvaticum*

Calyx subtruncate or minutely denticulate ; inflorescence-branches shortly pubescent ; leaves ovate, 3–5 cm. long, 1·5–3 cm. broad, subacute to acuminate, rather shortly pubescent on the midrib and lateral nerves, especially below, or sometimes almost glabrous ; pedicels slender, 5–8 mm. long, densely shortly pubescent ; an erect shrub with ascending branchlets.....13. *C. huillense*

Drupes large, the cells at least 1·5 cm. diam., about 2 in each infructescence ; leaves broadly elliptic, abruptly acuminate, 8–10 cm. long, 3–5 cm. broad, thinly adpressed-pubescent on the midrib and lateral nerves ; branchlets inserted at right-angles, bark grey.....12. *C. Brownii*

††Branchlets much abbreviated and bifoliate, or elongated, multifoliate and glabrous, or if slightly pubescent or puberulous then flowers 5-merous; inflorescence cymose or subumbellate:

‡Flowers 4-merous:

Inflorescence a dichasial cyme:

Leaves markedly parallel-venose above, lanceolate to rather narrowly ovate, up to 12 cm. long and 4·5 cm. broad, acute to acutely acuminate, cuneate to rounded at the base, glabrous when mature except in the axils of the 4–5 pairs of lateral nerves below, drying rusty brown; bark greyish; drupes small, numerous, didymous or globose.....14. *C. venosum*

Leaves not as above, tertiary nerves, when visible, reticulate:

Scrambling shrubs with the branchlets inserted at right angles:

Leaves oblong, acute or subacute, acute at the base, about 7·5 cm. long and up to 3 cm. broad, thinly pilose on the nerves below.....15. *C. syringodorum*

Leaves elliptic to oblong, acuminate, rounded to abruptly acute at the base, about 10 cm. long and 5 cm. broad, thinly pubescent on the nerves below 16. *C. zanzibaricum*

Trees or erect shrubs with ascending branchlets; leaves completely glabrous; inflorescence-branches puberulous:

Leaves with the midrib and lateral nerves (and sometimes the whole surface) below distinctly red in colour, ovate to oblong-elliptic, shortly and obtusely acuminate, acute to broadly rounded at the base, up to 12 cm. long and 6 cm. broad; petiole 5–8 mm. long; calyx truncate to undulately 4-lobed or 4-dentate, glabrous or very minutely ciliate on the edges of the lobes; corolla 5 mm. long; the ovary slightly exceeding 2 mm. in length.....17. *C. rubrocostatum*

Leaves not red below:

Branchlets subterete to obtusely subquadrangular; leaves ovate to oblong-ovate, acuminate, acute at the base, 6–12 cm. long, 2·5–5 cm. broad, with about 4 pairs of lateral nerves, green below.....18. *C. vulgare*

Branchlets acutely 4-angled; leaves very much as in *C. vulgare*, but usually rather larger, and with about 6 pairs of lateral nerves, drying blackish and shining.....19. *C. melanophengos*

Inflorescence unbranched or branching once dichasially, the branches terminating in many-flowered false umbels of pedicellate flowers; leaves elliptic, scarcely acuminate, acute or cuneate at the base, 6–10 cm. long, 3–5 cm. broad, with about 6 pairs of lateral nerves, drying almost black or dark reddish-brown; fruit 1-celled and globose, or didymous; a small tree.....20. *C. bibracteatum*

‡‡Flowers 5-merous; erect shrubs or trees (rarely semi-scandent):

Branchlets and leaves slightly pubescent when very young branchlets elongated, multifoliate (see above).....
10. *C. charadrophilum.*

Branchlets and leaves completely glabrous, or branchlets abbreviated and bifoliate:

§Stipules deciduous, not persisting beyond the current growth-season:

Cymes multiflorous; leaves oblong-lanceolate, shortly acuminate, mucronulate, acute at the base, 6–11 cm. long, 3·5–4·5 cm. broad; calyx subulately 5-dentate
21. *C. sclerocarpum*

Cymes about 8–15-flowered; leaves elliptic, ovate, or oblong:

Leaves scarcely acuminate, broadly rounded at the base, broadly elliptic, 7–8 cm. long, 3·5–5 cm. broad, slightly discolourous; branchlets with a light-coloured epidermis; bark almost white; fruit one-celled, ellipsoidal, about 3 cm. long.....
22. *C. Stuhlmannii*

Leaves gradually or abruptly acuminate, usually cuneate at the base; branchlets dark-coloured:

Mature leaves slightly discolourous, ovate or oblong-elliptic, 11–14 cm. long, 4–6 cm. broad, abruptly acuminate, acumen 1–1·5 cm. long, acute or shortly cuneate at the base, with about 5 pairs of lateral nerves; cyme-branches with a line of spreading pilose hairs on one side.....
23. *C. ruwenzoriense*

Mature leaves strongly discolourous, narrowly elliptic to oblong-elliptic, 4–7·5 cm. long, 2–3 cm. broad, gradually acuminate, usually cuneate at the base, with about 4–5 pairs of lateral nerves; bark yellowish; fruit often 2-celled, broadly ellipsoidal, 1·5–2 cm. diam.; cyme-branches with a few adpressed hairs, not in one line.....24. *C. captum*

§§Stipules very persistent, becoming woody:

‖Cymes with not more than 20 flowers; peduncle 1 cm. long or less:

Leafy shoots elongated, producing more than one pair of leaves each season; cymes about 12-flowered, borne in the axils of fallen leaves, peduncle up to 1 cm. long; leaves elliptic, oblong-elliptic or ovate, up to 12 cm. long and 6·5 cm. broad, shortly acuminate, with 4–6 pairs of lateral nerves; stipules long-acuminate, up to 2 cm. long; bark light-coloured, branchlets smooth.....
25. *C. keniense*

Leafy shoots very short, producing only one pair of leaves each season; cymes 3–10-flowered, peduncle not more than 5 mm. long:

Shoots (except the terminal one) in lateral opposite pairs, each with a pair of leaves, the latter appearing as though borne in whorls of 4 on the older branchlets; leaves narrowly elliptic to oblanceolate or obovate, 3–5 cm. long, 1–2 cm. broad, slightly acuminate, cuneate at the base, with about 3 pairs of lateral nerves.....
26. *C. pseudoverticillatum*

Shoots not as a rule in opposite pairs, the leaves obviously opposite, not apparently whorled as above:

Cymes 3–5-flowered, with very slender peduncles and pedicels, the peduncle often not more than 2 mm. long, pedicels 3–4 mm. long; leaves elliptic, 3·5–7 cm. long, 2–4·5 cm. broad, abruptly acuminate, acute at the base, with about 3 pairs of lateral nerves; bark soon becoming greyish-white and powdery...
27. *C. Robynsianum*

Cymes up to about 10-flowered, peduncle about 5 mm. long, fairly stout; leaves elliptic to sub-rhomboid, 4·5–8 cm. long, 3·5–4·5 cm. broad, abruptly acuminate, rounded to cuneate at the base, with 5–6 pairs of lateral nerves; bark purplish-brown and wrinkled...
28. *C. Siebenlistii*

|| ||Cymes with more than 20 flowers; peduncle 2 cm. long or more:

Leafy shoots with only one pair of leaves; stipules triangular, subacute, leathery, 1·5 cm. long; leaves oblong-elliptic, ovate or suborbicular, apex triangular, subacute, cuneate to cordate at the base, usually up to 9 cm. long and 6·5 cm. broad, but sometimes (pollard shoots?) 8–14 cm. diam.; petioles 1·5 cm. long; peduncles about 2·5 cm. long, puberulous, later glabrescent; pedicels very

short ; corolla rounded in bud, 2·5 mm. long.....
29. *C. lactescens*

Leafy shoots with more than one pair of leaves ; stipules lanceolate, long acuminate, 1 cm. long ; leaves obovate, obtuse to rounded, but sometimes almost acuminate at the apex, cuneate at the base, up to 14 cm. long and 8 cm. broad, glabrous above, glabrous or shortly tomentellous below ; peduncle about 2 cm. long, pedicels 1–3 mm. long ; branchlets glabrous or rarely lanate-tomentose, corolla acute in bud, 5 mm. long...30. *C. crassum*

**Peduncle obsolete, cymes branched from the base and flowers appearing to be fasciculate ; leaves narrowly lanceolate-elliptic, acuminate, subacute at the base, about 8 cm. long and 3 cm. broad, glabrous, lateral nerves numerous, very slender, distinct above, very indistinct below.....31. *C. subopacum*

2. **Canthium telidosma** (*K. Schum.*) *S. Moore* in Journ. Linn. Soc. Bot. xl. 87 (1911).—*Plectronia telidosma* K. Schum. in Engl. Bot. Jahrb. xxiii. 460 (1897).

Tanganyika Territory. Longuza, Dec., *Zimmermann G. 6113* (partly). Usambara, Feb. *Stuhlmann 6690* (type, Ber.).

The flowers were described as solitary by Schumann, and in the type specimen this is indeed the case. In Zimmermann's specimen, however, there are frequently two or more flowers borne on a common peduncle. In order to facilitate determination, this plant has been inserted also in the key to the *Fasciculate Series*, but there is no doubt that its general affinities are with the following species, which Zimmermann collected under the same number.

3. **Canthium microdon** *S. Moore* in Journ. Linn. Soc. Bot. xl. 86 (1911).

Tanganyika Territory. Longuza, Dec., *Zimmermann G. 6113* (partly).

Also in Gazaland (*Swynnerton 552*, at the British Msueum). The Tanganyika specimen is rather poor, and shows more numerous flowers per cyme than the type from Gazaland. In all other characters, however, they are identical.

4. **Canthium sordidum** (*K. Schum.*) *Bullock*, comb. nov.—*Plectronia sordida* K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 386 (1895).

Tanganyika Territory. Umpeke, *Stuhlmann 860* (type, Ber.) ; Kibwesi, Ukambwane, 3000 ft., Dec., *Scheffler 28*.

5. **Canthium indutum** *Bullock*, sp. nov.

Frutex scandens, ramis junioribus velutinis, ramulis lateralibus abbreviatis 2-foliatis. *Folia* sicco nigra, ovata, apice obtusa, basi rotundata, circiter 4–6·5 cm. longa et 2·5–5 cm. lata, utrinque breviter pubescentia, nervis lateralibus utrinsecus 3–4, petiolis

velutinis 5 mm. longis. *Flores* non visi, ut videtur in cymas corymbosas multifloras dispositi.

Tanganyika Territory. Kondoa-Irangi District, Jan., *Burtt 1294*.

The very incomplete material of this species shows evident affinity with *Canthium Junodii* Burtt Davy, from the Transvaal and Nyasaland.

6. **Canthium scabrosum** *Bullock*, sp. nov.

Frutex scandens pubescens, ramis angulo recto patentibus. *Folia* oblongo-lanceolata vel oblonga, apice longe acuminata, basi subcordata vel rotundata, 6–11 cm. longa, 2·5–5 cm. lata, utraque pagina dense pilosa, pagina superiore scabrescentia; ramuli ex axillis foliorum parvorum ovato-cordatorum orti. *Stipulae* pilosae, caducae, longe cuspidatae, 1 cm. longae. *Cymae* pedunculatae, dichasiales, multiflorae, pedunculo usque 1 cm. longo, pedicellis 3 mm. longis, bracteis linearibus, inferioribus circiter 5 mm. longis. *Calyx* subcampanulatus, 2·5 mm. longus, lobis triangularibus, tubo minus dense pilosis. *Corolla* alabastro apice rotundata, 5 mm. longa, lobis sub anthesin ovatis deflexis 2·5 mm. longis, fauce dense villosa. *Drupa* didyma, subglobosa, circiter 1 cm. diametro, strigulosopilosa.—*Canthium hispidum* S. Moore in Journ. Linn. Soc. Bot. xxxvii. 161 (1905), non Benth. (1849).

Uganda Protectorate. Entebbe, *Fyffe s.n.* (type). Without exact locality, a shrub with greenish flowers, Dec., *Bagshawe 54* (B.M.).

Tanganyika Territory. Kyimbila District, Bulambya-Ilembo, Oct., *Stolz 1618*. Namanyere, Konongo and Massiba, Dec., *Swynnerton 21*; *722* (B.M.).

As regards the East African specimens, this species is very distinct in its very densely hairy calyx, and in the scabridity of the upper surface of the mature leaf. Although the leaves are broader, a specimen from the Malange District, Angola (*Gossweiler 1251*) shows the same characters, but others show very evident affinities with *C. Gueinzii* Sond., and *C. rufivillosum* Robyns ex Hutch. & J. M. Dalz.* A specimen collected by Dr. Mildbraed (No. *9542*) in the Cameroons is reminiscent of *C. Gueinzii*, but the indumentum is much longer than in that species, and the scabridity of the upper surface of the leaves, though slight, is quite obvious. Excellent material recently collected in north-western Northern Rhodesia by Mr. E. Milne-Redhead (No. *813*, barren material, and No. *976*, fruiting material) is in some respects like *C. rufivillosum*, but its indumentum is less dense, even in the young (barren) state, while the fruiting material leaves no doubt that it is consepcific with Gossweiler's Angolan specimen (No. *1251*), and with the East African material from which the species has been mainly described. Mr. Milne-Redhead's notes on his two collections of this plant,

* Hutch. et J. M. Dalz. Fl. W. Trop. Afr. ii. 113 (1931).

together with those attached to the other specimens mentioned are appended :—

Cameroons. Buar-Buala, 3500 ft., June, *Mildbraed 9542.*

Angola. Malange District, near the Governor's Palace and Post Office, in waste places not reached by the annual fires, a woody climber not uncommon in shady places, climbing over neighbouring shrubs, Aug. (fr.), *Gossweiler 1251* (Kew & B.M.).

Northern Rhodesia. River Kasengiko, Camp 12*, a shrub or trailer among other shrubs in *Cryptosepalum* woodland, with tawny pubescence, Aug. (barren), *Milne-Redhead 813.* River Lunga, below Mwinilunga, a shrub up to 15 ft. high with pendulous branches and green fruits, Aug. (fruit), *Milne-Redhead 976.* Thirty miles north of Kasama, a shrub, 15 ft., in the *Brachystegia* woodland, July (fruit), *Hutchinson & Gillett 3808.*

7. **Canthium purpurascens** *Bullock*, sp. nov.

Frutex subscandens, ramulis patentibus dense tomentellis demum glabrescentibus, cortice flavido-albo. *Folia* sicco purpurea, oblongo-elliptica usque ovata vel obovata, apice abrupte et breviter angustato-rotundata, minute mucronulata, basi (saepe inaequaliter) rotundata, 5–6·5 cm. longa et usque 4 cm. lata, supra glabra, infra pubescentia, costa et nervis lateralibus (utrinsecus 5–6) molliter dense tomentosa, demum subglabrescentia ; petioli circiter 7–8 mm. longi, tomentosi ; stipulae mox deciduae, triangulari-cuspidatae. *Cymae* pedunculatae, corymbosae, multiflorae ; flores, ut videtur 5-meri, non visi. *Calyx* statu fructifero tomentosus, 5-dentatus. *Drupa* esculenta, didyma vel abortu 1-locularis, loculis subglobosis vel ellipticis 1 cm. longis.

Tanganyika Territory. Rufiji, 50 ft., semi-climbing shrub, fairly common in black alluvial soil in full sun, Dec., *Musk 67.*

8. **Canthium Gueinzii** *Sond.* in Linnaea, xxiii. 54 (1850), et in Harv. et Sond. Fl. Cap. iii. 16 (1864–5) ; S. Moore in Journ. Linn. Soc. xl. 89 (1911) ; Bullock in Hook. Ic. Pl. t. 3170 (1932).—*Plectronia Gueinzii* (Sond.) Sim, For. Fl. Cape Col. 241 (1907) ; Bews, Fl. Natal and Zululand 198 (1921). *Plectronia hispida* Battiscombe, Cat. Trees and Woody Pl. of Kenya Col. 106 (1926), partim, non *Canthium hispidum* Benth. (1849). *Keetia transvaalensis* Phillips, Gen. S. Afr. Fl. Pl. 587 (1926), et in Bothalia, ii. 369 (1927). *Canthium hispidum* Robyns in Notizblatt Bot. Gart. Berlin, x. 616 (1929), non Benth. (1849).

A scandent shrub climbing over trees in the forest with fragrant white or creamy flowers. The mature leaves are glabrous on the upper surface, except on the midrib and lateral nerves ; the tertiary veins are slightly impressed, a character which serves to distinguish this species from its several close allies.

Uganda Protectorate. Common. Exsicc.—*Snowden 861* ; *Sc. Elliott 7913.*

* Camp 12 of the Aerial Survey of the Zambesi Basin, 1930.

Kenya Colony. Common. Exsicc.—*Graham 1757. Battiscombe 203. R. E. & T. C. E. Fries 1627; 1764. Snowden 634. Rammell 1078. Dümmer 1685. Moon 752. Powell 135. Dale 2423.*

Tanganyika Territory. Common. Exsicc.—*Thomson s.n. Burtt 960; 1752. Swynnerton 761* (B.M.). *Lynes D.g. 122; F.j. 66; F.r. 51.*

This is perhaps the most widely distributed species of *Canthium* in Africa. It ranges from Abyssinia and the Sudan southwards to the Transvaal and Natal, where it was collected by Dr. Gueinzius, and westwards through Rhodesia to Angola in the south, and to the Cameroons Mt. in the north. In altitude it ranges from near sea-level to about 8000 ft.

9. **Canthium hispidum** *Benth.* in Hook. f. Nig. Fl. 409 (1849); Hiern in Oliv. Fl. Trop. Afr. iii. 140 (1877); et Cat. Welw. Afr. Pl. i. 476 (1898); Hutch. et J. M. Dalz. Fl. W. Trop. Afr. ii. 115 (1931).—*Plectronia hispida* (Benth.) K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 386 (1895), saltem partim; K. Krause in Mildbr. Wiss. Ergebn. Deutsch. Zentr.-Afr. Exped. 1907–8, ii. 326 (1914); K. Krause in R. E. Fries, Wiss. Ergebn. Schwed. Rhod.-Kongo Exped. 1911–12, i. Nachtr. 15 (1921), incl. var. *glabrescens* K. Schum.

Tanganyika Territory. Derema, Usambara, *Scheffler 193.* Sigi, March, *Soleman 5933.* Amani, 3000 ft., a common climber in the forest, flowers cream, Apr., *Burtt 426.* Lvani, Jan., *Braun 1030* (Am.); Oct., *Engler 3363* (Am.). Monga, Feb., *Zimmermann 6109* (Am.); *6110.*

Also in Rhodesia, westwards and northwards through the Belgian Congo and Upper Guinea, but apparently not occurring further north on the eastern side of Africa, where it is entirely replaced by *C. Gueinizi* Sond. A number of specimens not referable to either *C. Gueinzii* or *C. hispidum, sensu stricto*, have been seen, of which the following are examples.—Kyimbila District, *Stolz 577.* Moshi Rain Forest, 2300 ft., Jan., *Lewis 216*, Amani, "*Herb. Amani.*" *390.* Amani, Apr., *Braun 1862*(Am.).

10. **Canthium charadrophilum** (*K. Krause*) *Bullock*, comb. nov. —*Plectronia charadrophila* K. Krause in Engl. Bot. Jahrb. lvii. 36 (1920).

Tanganyika Territory. Bundeli Mts., Kyimbila District, 4000 ft., a scrambling shrub 30 ft. high, with yellowish flowers, growing at the edge of the forest, Oct., *Stolz 124* (type, Ber.).

This species is readily distinguished from the following by its very lax habit. It is very closely allied to the preceding.

11. **Canthium sylvaticum** *Hiern*, Cat. Welw. Afr. Pl. i. 477 (1898). —*Plectronia silvatica* (Hiern) K. Schum. in Just, Jahresb. 1898, 393 (1900). *Plectronia cuspido-stipulata* K. Schum. ex Engl. in Abh.

Preuss. Akad. Wiss. (1894) 53, nomen. *Plectronia hispida* Battiscombe, Cat. Trees and Woody Pl. of Kenya Col. 106 (1926), partim, non K. Schum. (1895) et non *Canthium hispidum* Benth. (1849).

Uganda Protectorate. Victoria Nyanza : Sese Is. ; Bungala Is., 3700 ft., Dec., *Maitland 393* ; Bubembe Is., 3700 ft. Dec., *Maitland 400* ; without exact locality, *Carpenter 8* ; *11* (Jan. 1913). Entebbe, a common plant at the edge of the forest, Oct., *Maitland 174*. Changa, Feb., *Sc. Elliott 7192*. Toro District ; Ibanda Hill, Nov., *Maitland ex Liebenberg 1075*.

Kenya Colony. Shimba Hills, a climbing shrub with white flowers, *Gardner 1435*. Nyanza Basin, 4500–5000 ft., *Moon 584*.

Tanganyika Territory. Mlalo, March, *Holst 2426*. Mt. Kilimanjaro : Mashani, 4000–5000 ft., a shrub with white flowers, Feb.-Apr. *Haarer 189* ; *1030* ; Marangu, 5000 ft., Oct., *Volkens 1105a* ; *Grote 5070*.

Also in Angola. Hiern described this species from one of Dr. Welwitsch's specimens (No. *3134*). It is readily distinguished from *C. hispidum* and *C. Gueinzii* by its discolourous leaves, with fine distinct reticulate venation on the lower surface.

12. **Canthium Brownii** *Bullock*, sp. nov.

Frutex scandens, ramis angulo recto patentibus subglabris pallide griseis, ramulis junioribus teretibus ferrugineo-pubescentibus glabrescentibus. *Folia* elliptica, apice breviter accuminata, basi cuneata vel acuta, 5–10 cm. longa, 3–5 cm. lata, costa et nervis lateralibus (utrinsecus 5–6) leviter adpresso-strigoso-pubescentia infra praesertim, petiolis ferrugineo-pubescentibus 7–10 mm. longis. *Cymae* dense multiflorae. *Calyx* pubescens, 4-dentatus. *Corolla* alabastro 3 mm. longa, 4-lobata. *Drupa* globosa vel didyma, loculis circiter 1·3 cm. diametro.

Uganda Protectorate. Entebbe, 3900 ft., a scrambling shrub with white flowers, June, *E. Brown 233* (type). Kimuri, 4000 ft., a scandent shrub of the forest edge with white flowers, July, *Dümmer 3238*.

13. **Canthium huillense** *Hiern*, Cat. Welw. Afr., Pl. i. 476 (1898).—*Plectronia huillensis* (Hiern) K. Schum. in Just, Jahresb. 1898, 393 (1900). *Plectronia heliotropiodora* K. Schum. et K. Krause in Engl. Bot. Jahrb. xxxix. 540 (1907).

Tanganyika Territory. Lake Tanganyika, Dec., *Bohm 68*. Mnemia, Kondoa-Irangi District, Dec., *Burtt 5395*. Irangi, 6400 ft., common, March, *Lynes I.g. 225a*. Dodoma District, 4000 ft., a shrub in the *Berlinia* forest, Dec., *Burtt 994*. Without exact locality, *Busse 1295* (Am.).

The type of *Plectronia heliotropiodora* was collected by *Busse* (No. *875*) in Ruanda. The leaves, which are very young, are very densely pubescent on both surfaces. There is no doubt, however, that it is conspecific.

Dr. Welwitsch's specimens (Nos. *3145* ; *3146*) from Angola are almost glabrous, but otherwise indistinguishable from those cited above ; the latter are also identical with the following Rhodesian and Transvaal specimens :—

Rhodesia. Katuba Stream, N.W. Rhodesia, on ant hills, Dec., *Kässner 2258*. Victoria Falls, a shrub 2–2½ ft. high, Jan., *Allen 250*. Salisbury, 4800 ft., *Eyles 6175*. Matopo Hills, Mar., *Eyles 6306*. Without exact locality, S. Rhodesia, Dec., *Jack in Herb. Eyles. 5052*. Between Kubango and Kuibo, 4000 ft., Dec., *Baum 502*.

Transvaal. Macalisberg, Dec., *Burke s.n.* Daspoort Rand, below River Redoubt, Oct., *Pole-Evans 164*. Woodstock, Rustenberg District, a tree 5–8 ft. high with masses of small cream flowers, Nov., *Pegler 2002*. Warm Baths, Waterberg District, Jan., *Burtt Davy 2328*. Without locality, *Zeyher in Herb. Wallich. 763*.

14. **Canthium venosum** (*Oliv.*) *Hiern* in Oliv. Fl. Trop. Afr. iii. 144 (1877) ; Hutch. et J. M. Dalz. Fl. W. Trop. Afr. ii. 115 (1931). [Figure 1].—*Plectronia venosa* Oliv. in Trans. Linn. Soc. Lond. xxix. 85, t. 49 (1873). *Canthium venosum* var. *pubescens* Hiern, l.c. *Canthium Barteri* Hiern, l.c. 143. *Plectronia Barteri* (Hiern.) De Wild. et Th. Dur. in Ann. Mus. Congo, Sér. 2, i. pt. 2, 33 (1900). *Canthium sphaerocarpum* Schweinf., MS. in Herb. Mus. Brit. et Herb. Kew. *Plectronia myriantha* K. Krause in Mildbr. Wiss. Ergebn. Deutsch. Zentr.-Afr. Exped. 1907–8, ii. 327 (1911), non Schlect. et K. Krause in Engl. Bot. Jahrb. xl. Beibl. 92, 43 (1908).

Uganda Protectorate. Madi Woods, Dec., *Speke & Grant s.n.* (type). Kitamilo, Buvuma, Mar., *Maitland ex Liebenberg 1266*. Nile Distr., shrub 10–15 ft. high, *Dawe 913*. Sozi Point, Bugala Is., Sese, 3850 ft., a climbing shrub with green flowers, common in scrub forest, Nov., *Eggeling ex Brasnett 255*. Mabira Forest, Mulange, 4000 ft., Jan., *Dümmer 4367*. Mouth of Bakora R., a shrub with greenish-white flowers, Jan., *Bagshawe 140* (B.M.).

Tanganyika Territory. Longuza, Dec., *Zimmermann 6116*. Monga, Nov., *Zimmermann 6117*. Without exact locality, *Busse 2620* (Am.).

Also in West Africa from Nigeria to French Guinea, Cameroons, Sudan, Congo, Northern Rhodesia and Angola (*Gossweiler 1233*). The single specimen of *C. sphaerocarpum* (*Schweinfurth 1387*) which has been seen at the British Museum Herbarium, is merely a narrow-leaved form of this species, but the Kew specimen of the same collection is quite typical in this respect, as also is *Schweinfurth 2487* in the Kew Herbarium. A further specimen (*Broun 43*) from Bahr-el-Ghazal, has very large (up to 15 cm. long) leaves. A specimen collected by Hutchinson and Gillett (No. *3610*) twenty-eight miles south of Broken Hill in Northern Rhodesia in July, 1930, has some leaves almost rotundate, but is nevertheless certainly referable to this species. Hutchinson and Gillett obtained typical specimens (No. *4051*) six miles north of Kasama. The type of *P. myriantha* was collected by Dr. Mildbraed (No. *684*) in the Virunga Mountains.

Fig. 1. *Canthium venosum* (Oliv.) Hiern ; A, habit ; B, flower ; C, pistil and calyx ; D, flower laid open ; E, anther ; F, infructescence ; F′, drupe in longitudinal section.

15. **Canthium syringodorum** (*K. Schum.*) *Bullock*, comb. nov.—*Plectronia syringodora* K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 386 (1895).

Tanganyika Territory. Karema, Lake Tanganyika, *Bohm 23a* (type, Ber.). Walla River, *Bohm 92a* (not seen, Ber.).

Also in the Belgian Congo.

16. **Canthium zanzibaricum** *Klotszch* in Peters, Reise Mossamb. Bot. 291 (1861) ; Hiern. in Oliv. Fl. Trop. Afr. iii. 138 (1877), incl. var. *glabristyle* Hiern, l.c. 139.—*Plectronia zanzibarica* (Klotzsch) Vatke. in Oesterr. Bot. Zeit. xxv. 231 (1875) ; Engl. in Abh. Preuss. Akad. Wiss. 26 (1894). *Canthium gracile* Hiern in Oliv. Fl. Trop. Afr. iii. 139 (1877), et Cat. Welw. Afr. Pl. i. 474 (1898). ? *Plectronia subcordata* K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 386 (1895), non *Canthium subcordatum* DC. Prodr. iv. 473 (1830). *Canthium tenuiflorum* Welw. ex Hiern, Cat. Welw. Afr. Pl. i. 477 (1898). *Plectronia tenuiflora* (Hiern) K. Schum in Just, Jahresb. 1898, 393 (1900).

Uganda Protectorate. Masaka, Kyotira District, a rambler, Oct., *Maitland 852*. Toro, 5000 ft., *Snowden 42*. Buddu, 4000 ft., *Dawe 33*.

Kenya Colony. Mombasa, *Wakefield s.n.* Rabai Ravine, Fimboni, Nov., *Taylor s.n.* (B.M.).

Tanganyika Territory. Amboni, *Holst 2721* ; *Kässner 5* ; *Braun 3495* (Am.). Without exact locality, *Marshall 39*. Kivindani, March, *Braun 1557* (Am.) ; *Stuhlmann 8320* (Am.).

Zanzibar Is. A very common scrambling shrub with white flowers. Exsicc.—*Hildebrandt 1157* ; *Kirk 55* ; *s.n.* ; *Kuntze s.n.* ; *Greenway 1266* ; *Taylor 18/2* ; *24/3* ; *Vaughan 1518*.

Pemba Is. Ole, a straggling shrub with white flowers, *Vaughan 288* (B.M.). Makongwe Isl., a very common white-flowered shrub with an unpleasant odour, Feb., *Greenway 1412*.

Also in Angola. The Zanzibar specimens are very constant in all characters except the degree of hairiness of the style, and it becomes necessary to discard Hiern's var. *glabristyle*. On the mainland variation is more pronounced, and the determinations of the Uganda specimens at any rate are to be regarded as merely tentative. A specimen collected by *Braun* (No. *5589*, Herb. Amani.) in the Bukoba District, differs in its narrower leaves and more hairy inflorescence. This form also occurs in Uganda [Changu, *Sc. Elliott 7192* (B.M.)].

17. **Canthium rubrocostatum** *Robyns* in Notizblatt. Bot. Gart. Berlin, x. 616 (1929).

Kenya Colony. Kiringa District, a small tree with sweet-scented flowers, Mar., *Fries 2107* (type). Solai Forest, 7800 ft., a medium-sized tree, *Gardner 1a* (Oxf.). Katimok Forest, Kamasa District, 7000–8000 ft., a tree 30 ft. or more high, growing as an understorey in the forest, with light grey bark and reddish leaves, Oct., *Dale 2437*. S.E. Mt. Elgon, 6500–7500 ft., a tree 20–30 ft. high, Dec. (fr.), *Jackson ex Lugard 322*.

Tanganyika Territory. Derema, Usambara, *Scheffler 151*.

The red colouration of the nerves on the lower surface of the leaves renders this species strikingly distinct. The red colour sometimes tinges the whole leaf, as indicated by Mr. Dale's notes above. Dr. Robyns allies this species to *C. Mannii* Hiern, a West African plant, but it is much more closely related to *C. vulgare* (*infra*) from which it is distinguished by the red colouration of the leaves and the larger, rather less numerous flowers.

18. **Canthium vulgare** (*K. Schum.*) *Bullock*, comb. nov.—*Plectronia vulgaris* K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 386 (1895); K. Krause in Mildbr. Wiss. Ergebn. Deutsch. Zentr.-Afr. Exped. 1907–8, ii. 326 (1914). *Canthium golungense* Hiern, Cat. Welw. Afr. Pl. i. 478 (1898). *Canthium golungense* var. *parviflorum* S. Moore in Journ. Linn. Soc. Bot. xxxvii. 161 (1905). *Plectronia golungensis* (Hiern) K. Schum. in Just, Jahresb. 1898, 393 (1900).

Uganda Protectorate. Many localities, 3000–5000 ft., a tree of the forest, bush and grasslands 15–30 ft. high, or occasionally reduced to the stature of a small shrub, with profuse white flowers. Exsicc. —*Carpenter 8* (July 1913). *Dümmer 890*; *1204*. *Fyffe 30*. *Maitland 69*. *Sc. Elliot 7220*; *7418* (B.M.). *Snowden 401*; *1923*. *Brasnett 95*; *418*. *Bagshawe 209* (B.M.); *1147* (B.M.).

Kenya Colony. Mowesa, a somewhat scandent shrub, 10 ft., flowers white and scented, *Graham 1823*.

Tanganyika Territory. Rubiri Forest, Bukira District, 4000 ft., a timber tree in the temperate rain forest, Nov., *Wigg 315*. Kome Is., Victoria Nyanza, 4000 ft., a heavily branched tree used for knee-pieces for dhows, April, *Bancroft 181*. Amboni, July, *Holst 2717*. Without exact locality, river junction, on bushy slopes, a shrub 4–6 ft. high, Aug., *Mildbraed 682* (Ber.). Bukoba, Feb., April, *Stuhlmann 1060*; *1547*; *3242*; *3620*; *3750*; *3978* (cited by K. Schumann—not seen—Ber.). Muansa, *Stuhlmann 4661* (Ber.). Victoria Nyanza coast, Speke Gulf, common among granite rock boulder kopjes, 3740 ft., an evergreen shrub with minute flowers, June, *Burtt 2470*.

Also in Gazaland (*Swynnerton 6211* at the British Museum), the Belgian Congo, Angola and Southern Nigeria (*Maitland 1721*), and probably also in French Guinea and Sierra Leone. This species was described from Dr. Stuhlmann's specimens, and there is no doubt that these are identical with *C. golungense* var. *parviflorum* described by Spencer Moore from Dr. Bagshawe's Uganda plant. Whether the writer is correct in reducing Hiern's Angolan *C. golungense* is more debatable. The only difference observed is in the rather laxer habit and generally somewhat larger leaves of the Angolan plant, both characters which might be expected in a shade form. Two other specimens, one from French Guinea (*Pobeguin 704*) labelled "*Canthium* sp." in the Kew Herbarium and one from Sierra Leone (*Deighton 1199*) labelled "*Canthium horizontale*" in the British Museum Herbarium, seem to be referable to this species.

They differ from the Angolan plants only in the rather more densely pubescent inflorescence. The notes attached to these two sheets are appended in full, since they greatly extend the hitherto known range of this species.

Pobeguin 704 :—French Guinea ; Juin, 1901 ; " Arbre moyen de 10 a 12 m. de haut ; feuillage vert vonce brillant ; fleurs nombreuses, blanches, odorantes." *Deighton 1199* :—Sierra Leone ; " tree 15 ft. ; fls. white, unpleasant smell."

C. vulgare may be regarded as the nearest African ally of *C. didymum* Gaertn. from Malaya.

19. **Canthium melanophengos** *Bullock*, sp. nov.

Arbor magna, glabra, ramulis prominente 4-angularibus usque subteretibus, ramis pallide brunneis, lenticellis prominentibus longitudinaliter elongatis. *Folia* sicco fere nigra, supra nitida, anguste ovata, apice gradatim acuminata, basi plerumque rotundata, 6–10 cm. longa, 2·5–4·5 cm. lata, nervis lateralibus utrinsecus 7–8, petiolis 5–7 mm. longis. *Cymae* dense multiflorae. *Calyx* ut videtur subtruncatus. *Corolla* non visa. *Drupae* plerumque abortu 1-loculares, numerosae, globosae, 7–9 mm. diametro.

Kenya Colony. Morigo's and Tusu, Mt. Kenya, 6600–7000 ft., a large timber tree, *Rammell 1054*.

Tanganyika Territory. Rukarara, Rugegi Forest, 6500 ft., a large tree with a tall straight trunk and very hard wood, Aug., *Mildbraed 1015* (type, Ber.).

20. **Canthium bibracteatum** (*Baker*) *Hiern* in Oliv. Fl. Trop. Afr. iii. 145 (1877).—*Plectronia bibracteata* Baker, Fl. Maurit. 146 (1877).

Kenya Colony. Kwale, a small tree with green flowers " with five red members " and pear-shaped, hard yellow fruits, *Graham 1653*.

Tanganyika Territory. Amboni, June, *Holst* 2713. Dar-es-Salam, *Holtz 319* ; *885* ; *2026* ; *2866* (all Ber.) ; *Braun 885* (Ber.) ; *Stuhlmann* 6341 (Ber.) ; *Kruger* 16 (Ber.).

Zanzibar Is. Without notes, *Kirk s.n.* A common shrub with yellow berries, 6–10 ft. high, growing on coral rock in open and closed bush formations, Feb., *Greenway 1309*. Kurekive-Kilima Kzall, a shrub or small tree up to 15 ft. high, much branched, flowers cream, fruits eaten by natives, Dec., *Greenway 2643*. Without notes, *Vaughan 1040 ; 1453 ; 1536*.

Also in the Mascarene Islands. The *locus classicus* is Mauritius. So far as has been ascertained this is the only East African species of *Canthium* which occurs so far away from the mainland ; it is also one of the most constant in its specific characters.

21. **Canthium sclerocarpum** (*K. Schum.*) *Bullock*, comb. nov.—*Plectronia sclerocarpa* K. Schum. in Engl. Bot. Jahrb. xxxiv. 334 (1904).

Tanganyika Territory. Lungusa, East Usambara, 300–550 ft. Sept., *Engler 389* (type, Ber.).

This species is very closely allied to *C. Afzelianum* Hiern, described from a Sierra Leone plant collected by Afzelius, and later recorded from the Anglo-Egyptian Sudan (*Broun s.n.*; *Snowden* 1703). A specimen from N. Rhodesia (*Macaulay 835*, from Mumbwa) differs from *C. Afzelianum* in the more hairy inflorescence and somewhat longer and less coriaceous stipules. Further material will probably disclose that these plants and *C. sclerocarpum* are identical. *C. congense* described by Hiern from " Lower Guinea, Congo " (*Chr. Smith s.n.*, at B.M.) may also belong here.

22. **Canthium Stuhlmannii** *Bullock*, sp. nov.

Frutex vel *arbor* glabra. *Folia* late elliptica, apice vix acuminata, basi late rotundata, 7–8 cm. longa, 3·5–5 cm. lata, paullo discoloria, petiolis usque 1 cm. longis; stipulae longe subulatae, basi latae, *Cymae* ut videtur pauciflorae. *Drupa* unilocularis, ellipsoidea, 3 cm. longa, 2 cm. lata.

Tanganyika Territory. Usaramo, *Stuhlmann 7007* (type, Ber.).

This is perhaps the most imperfectly known of all the new species described here; it is included merely for the record, but will need to be redescribed when more complete material becomes available.

23. **Canthium ruwenzoriense** *Bullock*, sp. nov.

Frutex vel *arbor* parva, glabra, 2–4 m. alta. *Folia* ovata vel oblongo-elliptica, apice abrupte et obtuse accuminata, basi acuta vel breviter cuneata, 11–14 cm. longa, 4–6 cm. lata, paullo discoloria, nervis lateralibus utrinsecus circiter 5, petiolis usque 1 cm. longis; stipulae 6 mm. longae, subulatae, basi latae, mox deciduae. *Cymae* circiter 10-florae, pedunculis 1–1·5 cm. longis, pedicellis 3–4 mm. longis unilateraliter pilosis. *Calyx* 5-lobatus, lobis anguste triangularibus. *Corolla* alabastro 5 mm. longa, apice acuta. *Drupa* non visa.

Uganda Protectorate. Butagu Valley, W. Ruwenzori, 6000–7000 ft., a shrubby tree 8–12 ft. high with bluish-green leaves and greenish flowers, Feb., *Mildbraed 2692* (type, Ber.).

24. **Canthium captum** *Bullock*, sp. nov.

Frutex vel *arbor* parva, omnino glabra, 2–4 m. alta, ramulis teretibus adscendentibus atratis, ramis vetustioribus cortice pallide flavo. *Folia* elliptica vel oblongo-elliptica, apice obtuse longe acuminata, basi plerumque cuneata, 4–7·5 cm. longa, 2–3 cm. lata, nervis lateralibus utrinsecus circiter 6, supra nitide flavido-viridia, infra griseo-viridia, petiolis circiter 5–8 mm. longis; stipulae subpersistentes, vix lignosae, subulatae, basi latae. *Cymae* usque 12-florae, pedunculis circiter 8 mm. longis, pedicellis usque 6 mm. longis. *Calyx* profunde 5-lobatus, lobis patentibus triangularibus 1·5 mm. longis. *Corolla* (non visa) " luteo-viridis." *Drupa* saepe 2-locularis, ellipsoidea vel leviter compressa, circiter 1·5 cm. diametro.

Tanganyika Territory. Kyimbila District: in the bamboo forest, a shrub about 6 ft. high with greenish-yellow flowers, glossy leaves, green with a yellowish tinge above, greyish-green below, ovary brown, Nov., *Stolz 2293* (type); Bundali, 6200 ft., a shrubby tree 12–14 ft. high, with glossy greyish fruits $\frac{3}{5}$ in. in diameter, with white dots, the leaves glossy, dark green with a yellowish tinge, March, *Stolz 2558*. Usambara: Kwai, Makambaberg, *Holtz 792a* (Ber.); *828* (Ber.).

This is very closely allied to the Abyssinian *C. oligocarpum* Hiern, the resemblance being particularly noticeable in the Holtz specimens cited.

25. **Canthium keniense** *Bullock*, sp. nov.

Arbor parva, 8–10 m. alta, omnino glabra, ramulis teretibus laevibus elongatis multifoliatis, cortice demum pallido et deciduo. *Folia* elliptica usque ovata, apice acuminata, basi rotundata usque cuneata, usque 12 cm. longa et 6·5 cm. lata, nervis lateralibus utrinsecus 4–6; stipulae persistentes, longe acuminatae, usque 2 cm. longae. *Cymae* circiter 12–20-florae, ramulis leviter pilosis, pedunculis usque 1 cm. longis. *Calyx* minutus, truncatus vel obsolete undulato-denticulatus. *Corolla* 4 mm. longa, 5-loba, tubo 2 mm. longo, lobis patentibus vel reflexis 2 mm. longis. *Drupa* abortu 1-locularis, oblongo-elliptica, 1·3 cm. longa.

Kenya Colony. Nairobi to Kikuyu, 5500–7000 ft., common, a small tree, 25–30 ft. high, *Battiscombe 872*. Ngong, 5500 ft., *MacDonald 830*. Arabuko, a small deciduous shrub or tree with green flowers, growing as an understorey in the *Brachystegia* forest, *Graham 1711*. Without exact locality, *Conservator of Forests* (1926) *28* (Oxf.).

26. **Canthium pseudoverticillatum** *S. Moore* in Journ. Bot. xliii. 352 (1903).—*Plectronia microterantha* K. Schum. et K. Krause in Engl. Bot. Jahrb. xxxix. 541 (1907).

Kenya Colony. Shimba Hills, western slopes, 1500 ft., March, *Kässner 383* (type); *416* (B.M.).

The verticillate appearance of the leaves in this species is due to the abbreviation of the opposite lateral branchlets. *Plectronia microterantha* was described from a specimen of the same number as S. Moore's type.

27. **Canthium Robynsianum** *Bullock*, sp. nov. [Figure 2].

Frutex erectus, glaber, cortice griseo-luteo, ramulis lateralibus brevibus 2-foliatis, internodiis brevissimis. *Folia* elliptica usque subrotundata, apice late et breviter acuminata, basi acuta vel subcuneata, 4–7 cm. longa, 2·5–4 cm. lata, chartacea, nervis lateralibus gracilibus utrinsecus 3–4, petiolis usque 7 mm. longis; stipulae longe subulatae, basibus persistentibus lignosis. *Cymae* 3–5-florae, brevissime gracilissime pedunculatae, pedicellis gracilibus 3 mm. longis. *Calyx* 5-triangulari-dentatus. *Corolla* alba, alabastro 2 mm. longa. *Fructus* non visus.

Fig. 2. *Canthium Robynsianum* Bullock; A, habit; B, flower; C, pistil and calyx; D, flower laid open; E, anther; F, stigma.

Kenya Colony. Mida, Malindi District, a tall shrub of the forest edge, or in the bush, with small white flowers, March, *Graham 2341* (type).

Named after Dr. Robyns, of Brussels, in recognition of his monograph of the *Vanguerieae*.

28. **Canthium Siebenlistii** (*K. Krause*) *Bullock*, comb. nov. *Plectronia Siebenlistii* K. Krause in Engl. Bot. Jahrb. lvii. 35 (1920).

Tanganyika Territory. West Usambara, 4500–6500 ft., Dec. *Siebenlist s.n.* (type, Ber.). Near Monya, 3000 ft., March, *Grote 3755* (Am., Ber.). Magambarvald, Feb., *Holtz 1846* (Ber.).

This is a small savannah tree which, like the two following species, develops a thick bark which serves as a protection against fire.

29. **Canthium lactescens** *Hiern*, Cat. Welw. Afr. Pl. i. 511 (1898). —*Canthium crassum* Hiern in Oliv. Fl. Trop. Afr. iii. 145 (1877), partim quoad spec. nutturense, excl. descr. *Canthium lactescens* var. *grandifolium* S. Moore in Journ. Linn. Soc. Bot. xxxvii. 161 (1905). *Plectronia lactescens* (Hiern) K. Schum. in Just, Jahresb. 1898, 393 (1900).

Uganda Protectorate. Ankole, 4500 ft., a small tree or shrub, *Dawe 376*. Near Mulema, June, *Bagshawe 329* (B.M.).

Tanganyika Territory. Kondoa District, in a rocky ravine in the hills opposite Kola, a small tree with cream-coloured flowers, Feb., *Burtt 1305*.

Also in Mittu-land (*Schweinfurth 1695*), Rhodesia and Angola. The Uganda specimens cited above belong to Spencer Moore's var. *grandifolium*, and they differ from the Angolan type (*Welwitsch 3157*) only in the large size and cordate base of the leaves. A form intermediate between the Uganda plants and the Angolan type occurs also in Angola (*Gossweiler 2405*), suggesting that these abnormal forms are merely specimens taken from very vigorous or pollard shoots. It seems likely also that *C. umbrosum* Hiern (Cat. Welw. Afr. Pl. i. 479; 1898), described from another of Dr. Welwitsch's Angolan plants (No. *2576*), is merely a pubescent form of this species. *C. Welwitschii* Hiern may also be an abnormal form of this species.

30. **Canthium crassum** (*Schweinf.*) *Hiern* in Oliv. Fl. Trop. Afr. iii. 145 (1877), partim quoad descr. et spec. djurense. *Vanguieria crassa* Schweinf. MS. *Canthium platyphyllum* Hiern, Cat. Welw. Afr. Pl. i. 479 (1898). *Plectronia platyphylla* (Hiern) K. Schum. in Just, Jahresb. 1898, 393 (1900). *Canthium optimum* S. Moore in Journ. Linn. Soc. Bot. xxxvii. 308 (1906); K. Krause in R. E. Fries, Wiss. Ergebn. Schwed. Rhod.-Kongo Exped. 1911–12, i. (Nachtr. 15 (1921). *Canthium amplum* S. Moore in Journ. Bot. lvii. 87 (1919). *Canthium acutophlebium* S. Moore l.c. *Plectronia*

buarica. Mildbr. in Notizblatt Bot. Gart. Berlin, ix. 203 (1924). *Plectronia opima* (S. Moore) Mildbr. *l.c.* 204, in obs. *Plectronia opima* var. *sudanica* Mildbr. MS. in Herb. Kew.

Tanganyika Territory. Kyimbila District, a shrub with greenish-yellow flowers and yellow edible fruits, Jan. (fl.), July (fr.), *Stolz 569 ; 1463*. Urundi, *Meyer 1806* (Ber., not seen).

Also in Djur-land, Eastern Sudan, Cameroons, Belgian Congo, Rhodesia, Shire Highlands (*Buchanan 196* ; *223* ; *s.n.*) and Angola. According to Mr. Taylor, of the British Museum Herbarium, this species occurs also in Kenya Colony, but the writer has seen no specimen from this area. The numerous descriptions of this plant cited in synonymy above are perhaps due to its having been collected in different stages or in different habitats. The shortly tomentose lower surface of the leaves in *Canthium amplum* and *Plectronia buarica* render this form strikingly distinct, but it seems certain that the indumentum soon falls off, leaving the typical form of *C. crassum*. The distribution of this form is interesting :—*C. amplum*, N.-W. Rhodesia (*Rogers 8446*) ; *Plectronia buarica*, Cameroons ; Buar, savannah of the Baja highlands (*Mildbraed 9330* ; *9459*). *C. platyphyllum* is a further form with a lanate tomentum on the inflorescence and young branchlets ; this falls away and the plant develops a rusty red-coloured bark. It is an Angolan form (*Welwitsch 2583*). Of the remaining synonyms, *C. dictyophlebum* was collected by the Rev. F. A. Rogers (No. *10085*) at Elisabethville in Katanga and is identical with specimens from Northern Rhodesia. An Angolan specimen (*Gossweiler 1239*) is also referable to this species. *Vangueria crassa* (*Schweinfurth 1707*), is from Djur-land, and is the type of this species.

Canthium crassum is a shrub or small tree occurring in the fire-swept grasslands of Tropical Africa. It develops a very thick, light bark, which serves as an extremely efficient protection against the intense heat of the grass fires. Specimens have been recently collected by Hutchinson and Gillett in N.-E. Rhodesia, while travelling with General Smuts's Botanical Expedition to Lake Tanganyika (1930), with the following notes : " No. *3691* ; a shrub 15 ft. in a moist dell in the *Brachystegia* forest, 5 miles E. of Chiwefwe." " No. *3813* ; a shrub 8 ft. with green fruits, 30 miles N. of Kasama, alt. 4500 ft." The fruits of the latter specimen must have been at least 3·5 cm. in diameter when fresh.

31. **Canthium subopacum** (*K. Schum. et K. Krause*) *Bullock*, comb. nov.—*Plectronia subopaca* K. Schum. et K. Krause in Engl. Bot. Jahrb. xxxix. 538 (1907).

Tanganyika Territory. Dar-es-Salam, Oct., *Stuhlmann 233* (type, Ber.).

A species remarkable for its inflorescence, first described as " fasciculate " but actually a sessile branched cyme which marks a close approach to the members of the following series.

*Flowers several in each fascicle :

Pedicels about 2·5 cm. long ; leaves glabrous, broadly elliptic, 3–5 cm. long, 2–3·5 cm. broad, rounded at the apex, decurrent to the base, venose reticulate above and below ; calyx limb very small, denticulate ; corolla about 7 mm. long in bud ; style long-exserted.....32. *C. micans*

Pedicels 1–1·5 cm. long :

Corolla 10–12 mm. long in bud, anthers exserted ; leaves ovate to obovate, 3–7 cm. long, 2–4·5 cm. broad, subacute to rounded at the apex, decurrent to the base, glabrous, shining above ; calyx very small, subtruncate or denticulate.....33. *C. Kaessneri*

Corolla 5–8 mm. long in bud :

†Pedicels glabrous :

Branchlets ascending ; a small tree ; leaves elliptic or oblong-elliptic, about 10 cm. long and 5 cm. broad, abruptly acuminate.....34. *C. clityophyllum*

Branchlets inserted at right-angles ; scandent shrubs :

Drupes large, 1 or 2 maturing in each fascicle, often 1-celled by abortion, each cell about 1 cm. diam. (when dry) ; leaves ovate, 6–10 cm. long, 3–6 cm. broad, shortly and abruptly acuminate, with about 3 pairs of indistinct lateral nerves ; stems becoming terete.....35. *C. egregium*

Drupes smaller, more numerous in each fascicle, each cell 4–5 mm. diam. :

Leaves shining above, oblong-ovate, up to 12 cm. long and 5·5 cm. broad, rather gradually acuminate, rounded to acute at the base, with about 5 pairs of lateral nerves ; stems becoming terete.....36. *C. malacocarpum*

Leaves dull above, elliptic, 6–8 cm. long, 3–4·5 cm. broad, very abruptly acuminate (acumen about 1 cm. long), acute or cuneate at the base, with 3–4 pairs of lateral nerves ; stems 4-angled, deeply furrowed.....37. *C. lacus-Victoriae*

††Pedicels densely puberulous ; trees or erect shrubs :

Corolla acute in bud ; leaves ovate or ovate-lanceolate, gradually and acutely acuminate, acute at the base, about 6 cm. long and 3 cm. broad ; pedicels up to 1·5 cm. long ; calyx-lobes broadly ovate ; corolla 6 mm. long in bud ; bark pale greyish brown...38. *C. euryoides*

Corolla rounded in bud ; leaves very much as in C. euryoides, but scarcely acute ; pedicels about 1 cm. long ; calyx subtruncate or undulately lobed ; corolla 6 mm. long in bud ; bark dark-coloured.....
39. *C. Schimperianum*

**Flowers 2–4 in each fascicle, or solitary :

Leaf margins not recurved ; erect shrubs or trees with ascending branches : leaves pubescent above and below, ovate to ovate-lanceolate, apex subacute, rounded at the base, about 2–4 cm. long and 1–2 cm. broad ; flowers solitary ; calyx deeply dentate ; ovary and young fruit clothed with a golden pubescence ; internodes about 5 mm. long (see also in the *Pedunculate Series* above)...2. *C. telidosma*

Leaf margins recurved ; usually a scandent shrub with the branchlets inserted at right-angles ; leaves elliptic to ovate, apex obtuse to rounded, rounded to subcordate at the base, 2·5–4 cm. long, 1·5–2 cm. broad, glabrous, shining above, margins recurved ; flowers in fascicles of 2–4 ; calyx obtusely 5-denticulate ; corolla 7 mm. long.....40. *C. recurvifolium*

32. **Canthium micans** *Bullock*, nom. nov.—*Plectronia lamprophylla* K. Schum. in Engl. Bot. Jahrb. xxiv. 335 (1904) ; K. Krause in R. E. Fries, Wiss. Ergebn. Schwed. Rhod.-Kongo Exped. 1911–12, i. (Nachtr.) 14 (1931) ; non *Canthium lamprophyllum* F. Muell. Fragm. ii. 133 (1860–61) ; *Plectronia nitens* K. Schum in Engl. Pflanzenw Ost-Afr. C. 385 (1895).

Tanganyika Territory. Dar-es-Salam, a shrub 6–10 ft. high, Nov., *Engler 2127* (type, Ber.).

Also in Northern Rhodesia (*Fries 1852, fide* K. Krause, *l.c.* not seen). The very long pedicels render this species strikingly distinct. K. Schumann first considered this species to be identical with *Canthium nitens* Hiern (not of DC.), but later corrected this mistake when he described *Plectronia lamprophylla*. *Canthium nitens* appears here under the new name *C. euryoides*.

33. **Canthium Kaessneri** *S. Moore* in Journ. Bot. xliii. 351 (1905). [Figure 3].—*Plectronia longistaminea* K. Schum. et K. Krause in Engl. Bot. Jahrb. xxxix. 542 (1907).

Kenya Colony. Near Gadu, 300 ft., March, *Kässner 418* (type).

Tanganyika Territory. Without exact locality, *Busse 556* (Am.).

Also in Portuguese East Africa (Msalu River-mouth, Lake Nyasa, a small bush 6 ft. high, on river banks, Feb., *Allen 119*). Schumann and Krause described *Plectronia longistaminea* from *Kässner 418*, the number which Spencer Moore had described two years previously. The large corolla and exserted stamens with comparatively long filaments are not closely paralleled among East African species of the genus.

34. **Canthium clityophyllum** *Bullock*, sp. nov.

Arbor parva, glabra. *Folia* elliptica vel oblongo-elliptica, apice abrupte acuminata, basi rotundata, 10–12 cm. longa, 3·5–5·5 cm. lata, nervis lateralibus utrinsecus circiter 4 supra prominentibus petiolis 5 mm. longis ; stipulae deciduae, anguste oblongae, basi latae,

Fig. 3. *Canthium Kaessneri* S. Moore; A, habit; B, flower; C, pistil and calyx; D, flower laid open; E, anther.

circiter 5 mm. longae. *Fasciculi* pro rata pauciflori. *Calyx* 5-denticulatus. *Corolla* alabastro leviter apiculata, 3 mm. longa, sub anthesin 5-lobata. *Drupa* didyma vel loculo altero abortivo globosa, loculis circiter 8 mm. diametro.

TANGANYIKA TERRITORY. Tana, Uluguru, 2000 ft., in clearings on mountain slopes, a small tree, Oct., *Stuhlmann 8928* (type, Ber.).

35. **Canthium egregium** *Bullock*, sp. nov.

Frutex vel arbor parva, glabra, usque 4 m. alta, ramulis gracilibus adscendentibus vel patentibus. *Folia* elliptica, apice abrupte acuminata, basi subacuta usque rotundata, 6–10 cm. longa, 3–6 cm. lata, supra nitida, nervis lateralibus inconspicuis utrinsecus 4. *Fasciculi* pro rata pauciflori. *Calyx* 5-lobatus, lobis triangularibus. *Corolla* non visa. *Drupa* didyma vel loculo altero abortivo globosa loculis usque 2 cm. diametro.

TANGANYIKA TERRITORY. Kyimbila District, 3500 ft., a climbing shrub 12 ft. high, without flowers, fruit glossy, glaucous green, leaves pale green on both surfaces, stem greenish brown but not shining, March, *Stolz 1914* (type, Ber.).

A species remarkable for the large size of its fruits, some of the two-celled examples being nearly 5 cm. across.

36. **Canthium malacocarpum** (*K. Schum. et K. Krause*) *Bullock*, comb. nov.—*Plectronia malacocarpa* K. Schum. et K. Krause in Engl. Bot. Jahrb. xxxix. 540 (1907).

TANGANYIKA TERRITORY. Ischana, Nov., *Stolz 92* (type, Ber.). Kyimbila District, Dec., *Stolz 1764*.

Also in N.E. Rhodesia ("a climber in patches of forest by the river E. of Chiwefwe, 15 July, 1930, *Hutchinson & Gillett 3693*") and in N. W. Rhodesia ("Solwezi Distr., evergreen vegetation by Mbulungu Stream near Mutanda Bridge, shrub 18 ft. high, with unripe fruit, June, 1930, *Milne-Redhead 629*.").

37. **Canthium lacus-Victoriae** *Bullock*, sp. nov.

Frutex scandens glaber, ramulis acute 4-angularibus. *Folia* elliptica, apice abrupte longe acuminata (acumine 1–1·5 cm. longo), basi acuta vel subrotundata, 7–8 cm. longa, 3·5–4·5 cm. lata, nervis lateralibus indistinctis utrinsecus 4, petiolis circiter 7 mm. longis. *Fasciculi* multiflori. *Flores* non visi. *Drupa* bilocularis vel abortu unilocularis, loculis globosis circiter 7 mm. diametro.

UGANDA PROTECTORATE. Victoria Nyanza; Sese Is., Sozi Is., 3700 ft., on the edge of the forest, Dec., *Maitland* 399; *424* (type). Entebbe, 3900 ft., common in the lakeshore forest, a bush up to 12 ft. high, with black fruits, Oct., *Eggeling ex Brasnett* 205.

38. **Canthium euryoides** *Bullock ex Hutch. et J. M. Dalz.* Fl. W. Trop. Afr. ii. 113 (1931)*.—*Canthium nitens* Hiern in Oliv. Fl. Trop. Afr. iii. 135 (1877), non DC. Prodr. iv. 474 (1830), nec *Plectronia*

* This name was published as follows: **C. euryoides** *Bullock* in Kew Bull. 1931, ined.

nitens K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 385 (1895). *Plectronia lucida* De Wild. et Th. Dur. in Ann. Mus. Congo, Ser. 2, i. II. 33 (1900), non K. Schum. et K. Krause in Engl. Bot. Jahrb. xxxix. 537 (1907), nec *Canthium lucidum* R. Br. (1814). *Canthium Schimperianum* S. Moore in Journ. Linn. Soc. Bot. xxxvii. 161 (1905), non A. Rich. (1847).

Uganda Protectorate. Kagera Valley, May, *Bagshawe 282* (B.M.).

Kenya Colony. Without exact locality, 6000–7500 ft., in dry country, *Battiscombe 84.*

Tanganyika Territory. Maschana, Usambara, March, *Holst* 8868.

Also in Southern Nigeria (*Barter 2114*), the *locus classicus* of Hiern's species, and in the Lake Kivu and Lake Albert areas of the Congo (*Kässner 3152* ; *3261*). I have not seen *Dewèvre 657*, the type of *P. lucida*, from the Congo, but from the description I believe it should be placed here.

39. **Canthium Schimperianum** *A. Rich.* Fl. Abyss. i. 350 (1847) ; Hiern in Oliv. Fl. Trop. Afr. iii. 135 (1877) ; Robyns in Notizblatt Bot. Gart. Berlin, x. 617 (1929).—*Canthium lucidum* R. Br. in Salt, Abyss. p. lxvii. (1814), nomen, non Schlecht. ex Hook. f. Fl. Brit. Ind. iii. 132 (1880), nec Hook. et Arn. Bot. Beech. Voy. 65 (1830), et non *Plectronia lucida* De Wild et Th. Dur. (1900). *Phallaria Schimperi* Hochst. in Pl. Schimp. Exsicc. i. 328, nomen nudum ; Hiern *l.c.* in syn. *Plectronia Schimperiana* (A. Rich.) Vatke in Linnaea, xl. 195 (1876) ; Engl. Hochgebirgsfl. Trop. Afr. 399 (1892) ; K. Schum in Engl. et Prantl, Nat. Pflanzenfam. iv. Abt. 4, 92, fig. 33, E-F (1897) ; Battiscombe, Trees and Woody Pl. of Kenya Col. 106 (1926). *Canthium myrtifolium* S. Moore in Journ. Bot. 266 (1907).

Uganda Protectorate. Forest near the mouth of the R. Mpanga, Toro, 3800 ft., Aug., *Bagshawe 1152* (B.M.).

Kenya Colony. Arabuko, a fairly tall forest tree, attaining a diameter of 2 ft., with numerous white flowers, dark-coloured rough bark with many longitudinal slits, and yielding a whitish hardwood said to be almost as good as *Brachychlaena*, June, *Graham 1995*. Without exact locality, a small tree, Jan., *Fries 1055*. Nairobi, Nyeri, 5500 ft., a medium sized tree in the *Brachychlaena* forest, *Gardner* 115 (Oxf.). (Also *Fries 247 ; 883 fide* Robyns, *l.c.*—not seen.)

Tanganyika Territory. Iringa, 6400 ft., a common small tree, March, *Lynes I.h. 255.*

Also in Abyssinia. According to Battiscombe (*l.c.*) this tree produces hard, easily-worked timber, and is common near Nairobi and in the Nandi Cedar forests.

40. **Canthium recurvifolium** *Bullock*, sp. nov.

Frutex scandens vel erectus, glaber, 3–5 m. altus, ramis teretibus angulo recto patentibus vel adscendentibus, ramulis primum

puberulis. *Folia* elliptica vel ovata, apice rotundata, basi rotundata vel subcordata, 2·5–6 cm. longa, 1·5–3·5 cm. lata, supra nitida, marginibus recurvis, petiolis brevissimis; stipulae anguste oblongae, 5 mm. longae, glabrae, mox deciduae. *Fasciculi* 2–4-flori, pedicellis 1 cm. longis parce puberulis, *Calyx* 3 mm. longus, limbo 5-lobato, lobis parce puberulis. *Corolla* alabastro apice acuta, 7–8 mm. longa, 5 lobata, lobis 3·5 mm. longis. *Drupa* 2-locularis vel abortu 1-locularis, compressa, ambitu obovata, 7 mm. longa, pedicello usque 2 cm. elongato parte superiore incrassato.

Kenya Colony. Mowesa, a scandent shrub growing near the edge of the swamp, the twigs inserted at right-angles, with white or cream flowers, *Graham 1751*.

Pemba Is. Bank of Chake-Chake Creek, a scandent shrub with white flowers growing over bushes and small trees on the cliff face in yellow sand, not common, Dec., *Greenway 2781* (type). Ras Mkumbuu, a much branched shrub with stiff erect branches growing in sand near the sea shore above high water mark, fairly common, Dec., *Greenway 2775*.

This is the only species occurring in East Africa which shows a definitely recurved leaf-margin, though a tendency in this direction is sometimes seen in small, ill-nourished examples of *C. Schimperianum*. Like many other species, its habit is erect with ascending branchlets when there is no other vegetation near by suitable for it to show its more usual scrambling habit. In the latter case, the branchlets are inserted at right-angles.

IV.—Anomalous Series.

Internodes very short; leaves rather small, narrowly oblong-elliptic to elliptic, usually about 2–2·5 cm. long and up to 1 cm. broad, but sometimes attaining 3–4·5 cm. long and 2 cm. broad, apex obtuse, base subacute; fascicles 3–6-flowered; corolla 2–2·5 mm. long.....41. *C. Greenwayi*

Internodes rarely less than 1 cm. long, usually much longer; leaves larger than above:

Flowers several:

Branchlets and stipules rusty-pubescent; leaves glabrescent, but petioles persistently pubescent; otherwise very much as in *C. pallidum* (below).....42. *C. Diplodiscus*

Branchlets, etc., quite glabrous; leaves oblong-elliptic to ovate or obovate, apex rounded to acute, rounded or abruptly acute at the base, usually up to about 7 cm. long and 4 cm. broad.....43. *C. pallidum*

Flowers solitary:

Pedicels up to 2 cm. long; leaves oblong or somewhat obovate-oblong, rounded at the apex, subtruncate at the base, up to 8 cm. long and 3 cm. broad; calyx-lobes glabrous, lanceolate, about 4 mm. long...44. *C. mombazense*

Pedicels 1 cm. long or less ; leaves ovate, obovate or elliptic, apex very obtuse or rounded, rounded to somewhat subcordate at the base, 2·5–4·5 cm. long, 1·5–2·5 cm. broad ; calyx-lobes glabrous, lanceolate, about 1·5 mm. long.....45. *C. inopinatum*

41. **Canthium Greenwayi** *Bullock*, sp. nov.

Frutex parvus, glaber, ramosissimus. *Folia* elliptica vel ovata, 1–3·5 cm. longa, 0·5–1·5 cm. lata (raro usque 4·5 cm. longa et 2 cm. lata), coriacea, petiolis 1·5 mm. longis ; stipulae lanceolatae, usque 5 mm. longae, membranaceae, mox deciduae. *Flores* 3–6, in axillis fasciculatis, pedicellis 5–7 mm. longis. *Calyx* profunde dentatus, dentis triangularibus 1 mm. longis. *Corolla* caduca, alabastro 2 mm. longa, apice minutissime apiculata. *Drupa* non visa.

Tanganyika Territory. Kisuani, S.E. Pares, 3000 ft., a small much branched shrub with greenish flowers, growing in shade in sandy soil on a rocky mountain slope, not common, Feb., *Greenway 2179*.

42. **Canthium Diplodiscus** (*K. Schum.*) *Bullock*, comb. nov.—*Plectronia Diplodiscus* K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 385 (1895).

Tanganyika Territory. Mlalo, Usambara, April, *Holst 583* (type, Ber.).

43. **Canthium pallidum** (*K. Schum.*) *Bullock*, comb. nov. [Figure 4].—*Plectronia pallida* K. Schum. in Engl. Bot. Jahrb. xxviii. 77 (1899).

Kenya Colony. Arabuko, a shrub 10 ft. high forming undergrowth in the forest, with greenish-white flowers which fall to pieces very soon after opening, or a small tree up to 20 ft. high in the bushland, *Graham 1968* ; *2340*. Mwachi, a small tree up to 12 ft. high with white flowers, growing as undergrowth in the forest or in the bush, *Graham 1762*. Mida, a shrub or small tree of the undergrowth, with white flowers, *Elliot 1544*. Without locality, a shrub of the coast forests, *Battiscombe 170*.

Zanzibar Is. Mangapwani, a small shrub with greenish inconspicuous flowers growing on the cliff top in coral rock, Jan., *Greenway 1151*. Without locality, Jan., *Stuhlmann 487* (type, Ber.). Without notes, *Vaughan 1780*.

44. **Canthium mombazense** *Baill.* in Baill. Adans. xii. 188 (1878).

Kenya Colony. Mombasa, *Boivin s.n.* (type, Paris).

Pemba Is. Ras Mkumbuu, a much-branched shrub up to 15 ft. high, with lax branches and small greenish white flowers, growing near the seashore above high-water mark, Dec., *Greenway 2774*. Pembe Is., Oct., *Burtt Davy 22460* (Oxf.). Pansa Is. (S.W. of Pemba Is.). A shrub growing in the shade of taller trees, not common, Feb., *Greenway 1410*.

The type of this species was collected during Boivin's journey of 1847–52.

Fig. 4. *Canthium pallidum* (K. Schum.) Bullock; A, habit; B, flower; C, pistil and calyx; D, flower laid open; E, anther.

45. **Canthium inopinatum** *Bullock*, sp. nov.

Frutex erectus (vel arbor parva ?), glaber, ramis subpatentibus leviter striatis, internodiis circiter 1–2 cm. longis. *Folia* ovata vel obovata vel elliptica, apice valde obtusa vel rotundata, basi rotundata usque subcordata, 2·5–4·5 cm. longa, 1·5–2·5 cm. lata, petiolis 1–2 mm. longis; stipulae oblongo-lanceolatae, acutae, membranaceae, 5 mm. longae. *Flores* in axillis solitarii, pedicellis 5–8 mm. longis. *Calyx* campanulatus, 3 mm. longus, profunde 5-lobatus, lobis glabris lanceolatis 1·5 mm. longis. *Corolla* apiculata. *Drupa* non visa.

Tanganyika Territory. Ukambane, Nov., *Sc. Elliot 6380*. Closely allied to the preceding, on account of its solitary flowers, though differing in leaf-shape, the shorter pedicels and smaller flowers, this species shows evident affinity with both *C. pallidum* and *C. Diplodiscus*, both of which, however, have several flowers in axillary fascicles.

Excluded Species.

1. *Plectronia xanthotricha* K. Schum. in Engl. Bot. Jahrb. xxxiv. 335 (1904), is perhaps better referred to *Hutchinsonia* Robyns, under the name **H. xanthotricha** (*K. Schum.*) *Bullock*, comb. nov.

2. *Plectronia bugoyensis* K. Krause in Mildbr. Wiss. Ergebn. Deutsch. Zentr.-Afr. Exped., 1907–8, ii. 327 (1911), is congeneric with the preceding, and a new combination, **Hutchinsonia bugoyensis** (*K. Krause*) *Bullock*, is therefore made for it.

The two species above have much shorter corolla-tubes than the two West African plants on which Dr. Robyns founded the genus. Some slight modification of the generic characters is therefore necessary.

3. *Plectronia kidaria* K. Schum. et K. Krause in Engl. Bot. Jahrb. xxxix. 537 (1907), is **Rytigynia kidaria** (*K. Schum. et K. Krause*) *Bullock*, comb. nov.

4. *Plectronia amaniensis* K. Krause in Engl. Bot. Jahrb. xliii. 142 (1909), is **Rytigynia amaniensis** (*K. Krause*) *Bullock*, comb. nov.

5. *Plectronia Eickii* K. Schum. et K. Krause in Engl. Bot. Jahrb. xxxix. 538 (1907), is **Rytigynia Eickii** (*K. Schum. et K. Krause*) *Bullock*, comb. nov.

6. *Canthium phyllanthoideum* Baill. in Baill. Adans. xii. 220 (1878), is **Rytigynia phyllanthoidea** (*Baill.*) *Bullock*, comb. nov.

7. *Canthium didymocarpum* Peters MS. in Herb. Amani. is better placed in *Rytigynia* (*Zimmermann G. 6107*, from Longuza).

8. *Canthium pubipes* S. Moore in Journ. Bot. xliii. 352 (1905), is a Rubiaceous plant which I exclude from *Canthium* on account of its terminal inflorescence. It may be a species of *Psychotria*, but the material is scarcely sufficient to decide the point.

LII.—RESEARCHES ON SILENE MARITIMA AND S. VULGARIS*: X. Investigation of the Vascular Anatomy of the Flowers of Silene maritima.

C. A. Pratt (Imperial College of Science and Technology).

The material on which this investigation is based was collected at Potterne from numbered plants of *Silene maritima*. Flowers of these plants were examined anatomically in order to substantiate, if possible, the suggestion put forward by R. O. Whyte (Nature, cxxiii. 113: 1929 and Journ. Genetics, xxiii. 109: 1930) that the sexual and petal differences exhibited might be due to, or at least correlated with, variations in the vascular anatomy (" vascular bundle supply ") of the flowers.

Some of the flowers investigated showed poor petal development, others deficient anther development (functionally female), and some were defective in both respects.

This material was derived from the following plants :—

N 16 (=A 13 selfed) Plant 1—Poor petals and anthers deficient.
N 16 (=A 13 selfed) Plant 3—Poor petals and normal anthers.
A 13—Poor petals.
A 2—Anthers deficient.
A 11—Normal hermaphrodite.
A 6—Normal hermaphrodite.

Methods.

(i) Flowers of each of these were cleared in Eau de Javelle, stained in ammoniacal fuchsin and mounted entire.

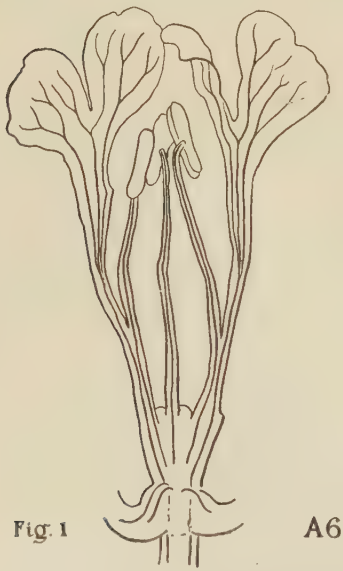


Fig. 1 A6

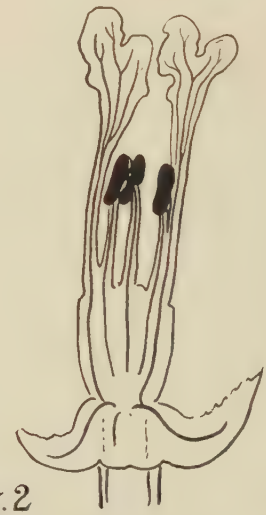


Fig. 2 A13

*Continued from *K.B.* 1932, 276.

(ii) Flowers were cut approximately in half and the ovary removed. The half flower was cleared in Eau de Javelle, stained in ammoniacal fuchsin and then mounted.

(iii) Longitudinal sections were cut through the flowers. All of the sections of any one flower were stained and mounted together. These sections were stained either with safranin and haematoxylin, or with ammoniacal fuchsin. The latter stain proved the more satisfactory.

(iv) Series of transverse sections were cut through the base of the flower from the level of the calyx attachment to that where the petals and stamens become free from the receptacle. All of the sections from any one flower were stained and mounted together.

Fig. 3 A 2

Results.

The entire flowers in method (i) did not show the vascular system sufficiently clearly though it was evident that in every flower examined the vascular supplies were abundantly developed. Cutting the flowers, as in (ii), and removing the ovaries made it possible to follow the vascular strands with some degree of certainty. Typical results are shown in the diagrams, Figs. (1), (2), and (3), which are drawn as nearly as possible on the same scale. Fig. (1) was drawn from A 6 with normal petals and anthers, Fig. (2) from N 16 with poor petals and deficient anthers, Fig. (3) from A 2 with normal petals and deficient anthers.

These diagrams serve for comparison of the relative sizes of the stamens and petals in the different flower types, as well as to show vascular supplies to petals and stamens.

Figs. (4) and (5) have been drawn from a large number of longitudinal sections obtained by method (iv).

Fig. (4) represents the vascular system as seen in flowers of plants A 6 and A 11 (both normal), and A 13 (poor petal). The vascular strands were well developed in every flower to stamens, to normal petals, and to poor petals. The same was found to be true of flowers of A 2 (anthers deficient) and of N 16 (poor petals and anthers deficient).

Fig. 4

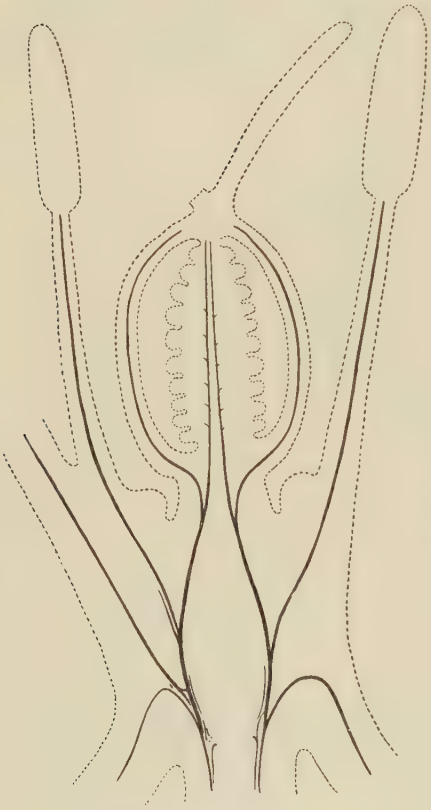
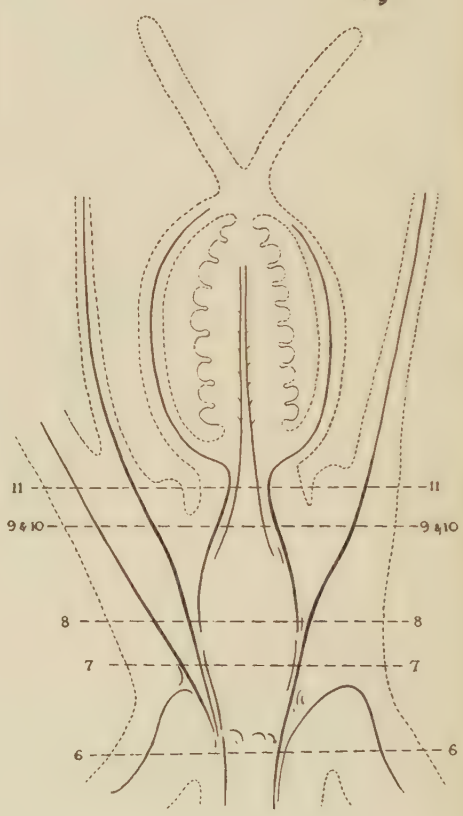


Fig. 5



The results obtained by method (iv) are shown in Figs. (6)–(11). Fig. (5) shows the approximate levels of the sections from which the drawings were made. The investigation made it clear that the vascular systems are alike and equally developed in all of the flowers, whether normal, or with poor petals, or with deficient anthers, or if deficient in both petals and anthers. A similar series was obtained for every flower. The drawings have intentionally been made from sections selected from different series in order to emphasise this point. The source of the section is indicated below. It will be noticed that these sections provide an essentially continuous series.

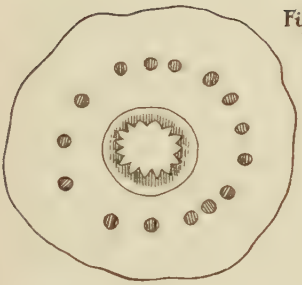


Fig.6

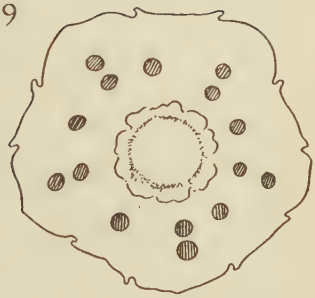


Fig. 9

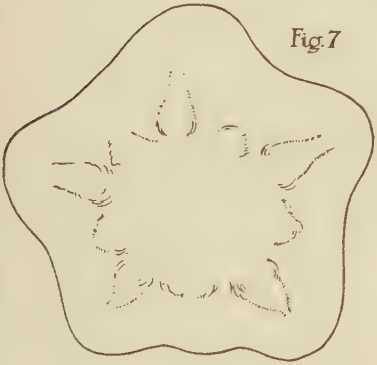


Fig.7

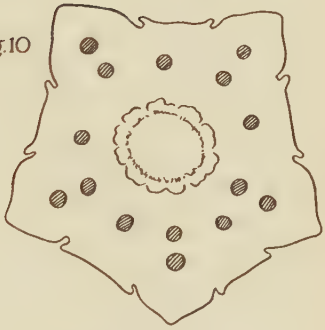


Fig.10

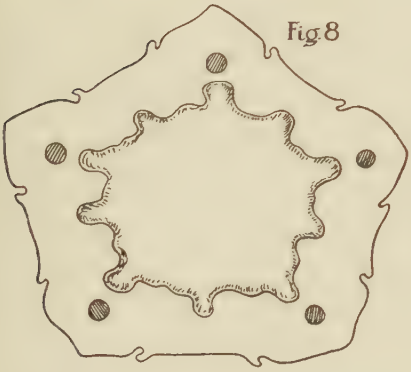


Fig.8

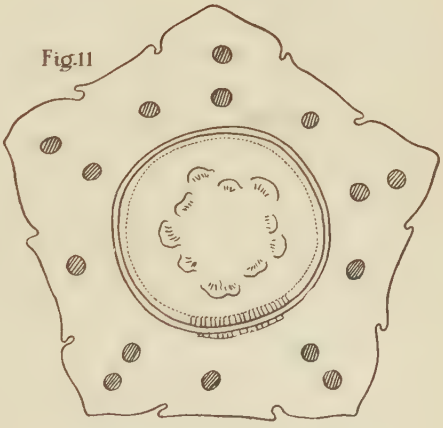


Fig.11

Diagrams of sections through base of flower of Silene maritima, passing upwards.

Fig. (6) Vascular supply of axis and small strands passing down and out to calyx (from N 16).

Fig. (7) Petal strands leaving central cylinder, which has by now widened out considerably (from A 11).

Fig. (8) Five petal strands isolated : origin of outer and inner stamen strands by fluting of central cylinder (from A 13 and A 2).

Fig. (9) Five petal and ten stamen strands clearly and strongly developed : drawn from N 16 (poor petals and anthers deficient) : ridges at bases of petals not pronounced.

Fig. (10) Five petals and ten stamen strands as seen in normal hermaphrodite flower (A 11) : pronounced ridges at bases of petals.

Fig. (11) Petals and stamens free from receptacle : vascular supply to ovary wall separating out.

Conclusion.

All the evidence obtained by each of the four methods described above points to the conclusion that the failure in certain of the flowers of plants of *Silene maritima* to complete the development of anthers and of petals cannot be ascribed to any anatomical defects of the vascular bundles. Early cessation of growth of the parts is not, then, due to failure of nutrition resulting from an inadequate vascular supply. The stamens and petals cease to grow in spite of the fact that the vascular strands are as well formed as in normal plants. Indeed, as will be seen by comparing Figs. (9) and (10) the difference between the poor and normal petals is already evident at such a low level as, obviously, to be quite independent of the vascular supply. The petal strands are equally well developed in the two flowers, but only the normal petals have a strongly ridged base.

Imperfect flower development does not, then, seem to be conditioned by the vascular supply, for in this respect all the flowers of *Silene maritima*, perfect and imperfect, are indistinguishable.

Literature.

(i) *Marsden-Jones, E. M. and Turrill, W. B.* " Researches on Silene maritima and Silene vulgaris." Kew Bulletin, 1928, 1 ; 1929, 33, 145 ; 1931, 118, 345.

(ii) *Whyte, R. O.* " Dioecism in Ranunculus acris," Nature, cxxiii. 13 (1929).

(iii) *Whyte, R. O.* " Researches on Silene maritima and Silene vulgaris." Kew Bulletin, 1929, 197.

(iv) *Whyte, R. O.* " Studies in Ranunculus : II, The cytological basis of sex in R. acris L." Journ. Gen. xxi. 183–193 (1929).

(v) *Whyte, R. O.* " Sterility and Floral Abnormality in the tetraploid *Saxifraga potternensis*." Journ. Gen. xxiii. 93–121 (1930).

LIII.—CONTRIBUTIONS TO THE FLORA OF TROPICAL AMERICA. XIV.* N. Y. Sandwith.

Mora and Dimorphandra in British Guiana.

These two genera, like *Eperua* (Wallaba), are of considerable economic and ecological importance, and the time has come for a taxonomic treatment of the species occurring in British Guiana. The small genus *Mora*, which has sometimes been merged in *Dimorphandra*, includes the famous Mora of the Arawaks, which is one of the largest and best-known trees in the Colony and has been repeatedly mentioned by such writers as the Schomburgks, and the less well-known Morabukea, a large tree of equal ecological significance, which has only recently been described as a distinct species, while the flowers are described for the first time in this paper. A full account of the ecology of the Mora and Morabukea consociations or forest-types in British Guiana will appear shortly in the Journal of Ecology, in a paper by Messrs. P. W. Richards and T. A. W. Davis.

Dimorphandra is a very interesting genus of about 18 species occurring in Guiana and Brazil, and in Amazonian Venezuela. This number will probably be increased by further exploration in the interior of Guiana and adjacent Brazil, since of the six species known in British Guiana four are described here for the first time. In British Guiana, at any rate, the species of *Dimorphandra*, unlike those of *Mora*, are always found in the "white sand" patches of the coastal region or in the wide sandstone areas of the interior where more species will almost certainly be discovered. They may be small trees of the savannah type of vegetation (*D. conjugata* and *D. cuprea*), or very large trees with an immense girth (*D. Davisii*). One of them, *D. macrostachya*, is a conspicuous feature of the flora of the slopes of Roraima, but has not yet been met with on Duida, at the western extremity of the Pacaraima Range.

A most useful recension of *Dimorphandra* and *Mora* was given by Dr. Ducke in Arch. Jard. Bot. Rio de Janeiro, iv. 39–45 (1925). Sufficiently convincing arguments were given there for the retention of *Mora* as a good genus, but Dr. Ducke might have stressed two floral characters of *Mora*, the woolly deciduous hairs at the apex of the anthers, and the long style, which appear to be constant in the South American species and in *M. megistosperma* (Pittier) Britton et Rose (*M. oleifera* Ducke) of Panama although, to judge from descriptions, they are not present in the two isolated species of Hispaniola, *M. Ekmanii* (Urb.) Britton et Rose and *M. Abbottii* Rose et Leonard.

In his review of *Dimorphandra*, Ducke has shown that the staminodial characters, which were originally used by Tulasne to distinguish the two sections *Eudimorphandra* and *Pocillum*, are by no means so clear-cut as had been supposed. This is still further borne out by

*Continued from *K.B.* 1932, 317.

examination of the British Guiana species, and one is led to the conclusion that there is no correlation whatever between such characters and the others, such as inflorescence and fruit, which certainly distinguish the species forming the two sections. Thus the staminodes of *D. Davisii* (§ *Pocillum*) and of *D. conjugata* (§ *Eudimorphandra*) are free and anantherous; those of *D. congestiflora* and *D. Hohenkerkii* (both § *Pocillum*) are free and antheriferous; while those of *D. cuprea* (§ *Pocillum*) are coherent and antheriferous. The staminodes of *D. macrostachya* (§ *Pocillum*) are unfortunately unknown. The presence or absence of rudimentary anthers on the staminodes is presumably of no great taxonomic value, since of two closely allied species, *D. cuprea* and *D. velutina* Ducke, they are present in the former and absent in the latter. There remains the actual shape of the lamina of the staminode; the value of this has been greatly exaggerated, and it does not appear to be capable of employment as a sectional character.

Mention must be made of Ducke's misleading interpretation of *D. polyandra* Benoist and *D. macrostachya* Benth. Relying on portions of the original descriptions, he has placed these species in a part of his key comprising plants with truly spicate (sessile) flowers. Both species, however, have very distinctly pedicellate flowers, and the Brazilian *D. macrostachya* Ducke is obviously a misidentification and bears no resemblance to the Roraima species; it seems, on the other hand, to be closely allied to *D. congestiflora* of the present paper.

Dr. Ducke made no reference in his account to *D. megacarpa* Rolfe, which was described from leaves and fruit only, but he had already reduced it to *Parkia multijuga* Benth.—see Arch. Jard. Bot. Rio de Janeiro, iii. 79 (1922).

Key to Mora and Dimorphandra.

Leaves simply pinnate, wholly glabrous; anthers (in S. American species) with conspicuous deciduous white hairs; style longer than the glabrous (in British Guiana species) ovary; seeds large, reniform, soft, with membranous testa, exalbuminous..... *Mora* Benth.

Leaves bipinnate, never wholly glabrous; anthers always glabrous; style much shorter than the villous (in British Guiana species) ovary; seeds (*fide* Ducke) small, nearly cylindric or oval and flattened, very hard, with coriaceous testa, albuminous..... *Dimorphandra* Schott

Key to the British Guiana Species of Mora.

Bark greyish-brown; leaflets 3–4-jugate, finely and intricately reticulate beneath; ovary distinctly stipitate.....1. *excelsa*

Bark rich brown; leaflets 2-jugate, laxly reticulate beneath; ovary sessile or barely stipitate.....2. *Gonggrijpii*

1. **Mora excelsa** *Benth.* in Trans. Linn. Soc. xviii. 210, tt. xvi, xvii (1839); Griseb. Fl. Brit. W. Ind. 216 (1860); R. O. Williams in

Flora of Trinidad and Tobago, i. 285 (1931).—*M. guianensis* Schomb. ex Benth. et Hook. f. Gen. Pl. i. 588 (1865), pro syn. ; Baill, Hist. Pl. ii. 149 (1870), in adnot. ; Ducke in Arch. Jard. Bot. Rio de Janeiro, iv. 45 (1925). *Dimorphandra Mora* Benth. et Hook. f. Gen. Pl. i. 588 (1865) ; Record, Timbers of Tropical America, 225 (1924). *D. excelsa* Baill. Hist. Pl. ii. 167 (1870), in obs. ; Pulle, Enum. Pl. Surinam, 209 (1906) ; Pittier in Trab. Mus. Com. Venezuela, iii. 133 (1928). *D. guianensis* Baill. l.c. 149, in adnot.

Arbor excelsa, cortice cinereo usque cinereo-brunneo. *Folia* omnino glabra, internodiis rhacheos usque 5·5 cm. longis ; foliola 3–4-juga, matura oblonga, elliptica vel elliptico-oblonga, apice rotundata saepissime leviter emarginata vel brevissime obtuse cuspidata, basi saepius rotundata vel obtusa sed nonnunquam cuneata, 6–19 cm. longa, 2·5–7·5 cm. lata (in plantis incipientibus majora, forma valde diversa, anguste elliptica, apice attenuata, longe acuminata, basi attenuata acuta), coriacea, utrinque praesertim supra nitida, costa utrinque elevata, nervis ceteris utrinque obviis, reticulatione densa valde intricata praesertim subtus prominente. *Inflorescentiae* spicatae, spicis apice ramulorum paniculatis dense breviter albo-pilosulis 8–25 cm. longis genitalibus exclusis ad 1·7 cm. diam. *Calyx* cylindrico-campanulatus usque campanulatus, lobis inclusis circiter 4 mm. longus atque latus, extra glaber vel pilosulus, tubo intus pubescente ; lobi rotundato-semicirculares, 1–1·25 mm. longi, 1·5–2 mm. lati, valde albo-ciliati. *Petala* spathulata, 5·5–6 mm. longa, vix 2·5 mm. lata, glabra sed dimidio superiore valde ciliata. *Stamina* filamentis 7 mm. longis ; antherae ellipticae, 1·5 mm. longae, 1 mm. latae, pilis albis longis mox deciduis dense lanato-barbatae. *Staminodia* glabra, filamentis 6–7 mm. longis ; lamina anguste clavata, 1·5 mm. longa, vix 0·5 mm. lata. *Ovarium* distincte (0·7 mm. vel saepius longius) stipitatum, ellipsoideum, glabrum, stylo multo longiore. *Legumen* glabrum, 13–21 cm. longum, 5–7·5 cm. latum, seminibus 1–2 reniformibus usque 12·5 cm. longis, usque 7 cm. latis.

Without locality, *Robert Schomburgk* 496 (type), 148 ; *Parker*. Demerara River, fl. June, 1889, *Jenman* 5096. Pomeroon River, fl. March 1884, *Jenman* 2006. Flat ground near Pomeroon River, fl. Jan. 1931, *Chapelle* in *Forestry Department* record no. 1013. Baboon Island, Kurupukari, Essequibo River, fl. July 1920, *Hohenkerk* in *F.D.* no. 844. Near Tinamu Fall, Cuyuni River, fl. March 1931, *Martyn* 267. Stop-off Fall, Cuyuni River, fl. Feb. 1931, *Brinsley* in *F.D.* no. 2051. On right bank below the Akaio Falls, Cuyuni River, seedling leaves only, Nov. 1929, *Sandwith* 701.

Vernacular name (Arawak), " Mora."

Distr. Guiana ; Trinidad ; Eastern Venezuela, in the Orinoco Delta.

The Trinidad material has the calyx pilosulous on the outer surface ; that of British Guiana specimens is usually, but not always —see *Martyn* 267—glabrous outside except for the ciliate lobes.

The leaflets of seedlings are remarkably different in shape and size from those of the mature tree.

2. **Mora Gonggrijpii** (*Kleinh.*) *Sandwith*, comb. nov.—*Dimorphandra Gonggrijpii* Kleinh. in Rec. Trav. Bot. Néerl. xxii. 410 (1925); Sandwith in Kew Bull. 1931, p. 367–8.

Arbor excelsa, cortice laete brunneo. *Folia* omnino glabra, petiolo 1–6 cm. longo, internodio rhacheos 1·5–5 cm. longo, petiolulis 4–8 mm. longis; foliola bijuga, elliptica, obovato-elliptica vel ovata (semper eis *M. excelsae* multo minus oblonga), apice breviter late obtuse acuminata vel cuspidata, basi cuneata acuta usque obtusa fere rotundata, 5–15 cm. longa, 2·5–7·5 cm. lata (in plantis incipientibus majora), tenuiter coriacea, utrinque praesertim supra nitida, costa utrinque elevata, nervis ceteris supra obviis sed venulis inconspicuis, subtus laxe prominenter reticulatis. *Inflorescentiae* spicatae, spicis apice ramulorum paniculatis; spicae ut in *M. excelsa* breviter albo-pilosulae, usque 9 cm. longae, genitalibus exclusis 1–1·5 cm. diametro. *Flores* sessiles, cremeo-albi. *Calyx* maturus campanulatus, lobis inclusis 3·5–4·5 mm. longus, 4–5 mm. latus, extra glaber, tubo intus pubescente; lobi late rotundato-ovati, 1·5–1·75 mm. longi, 1·75–2 mm. lati, albo-ciliati. *Petala* spathulata, vix 6 mm. longa, 2–2·5 mm. lata, dimidio superiore ciliata, ceterum glabra. *Stamina* filamentis glabris, maturis ad 8 mm. longis; antherae elliptico-oblongae, 1·75–2 mm. longae, 1 mm. latae, ut in *M. excelsa* pilis albis longis mox deciduis dense lanato-barbatae. *Staminodia* libera, glabra, filamentis 4–5 mm. longis; lamina ovata usque clavato-elliptica, 1–1·2 mm. longa, 0·5 mm. lata. *Ovarium* sessile vel subsessile, ellipsoideum, sub anthesi 3 mm. longum, 1·5 mm. diametro, glabrum; stylus glaber, 5–7 mm. longus; ovula 4–5. *Fructus* maturus ignotus; semen teste Kleinhoonte medio connatum, rotundatum, applanatum.

Matope Line, Cuyuni River, fl. Feb. 1931, *Davis* in *Forestry Department* record no. 1033: " moderately large tree, about 130 ft. high, 14 in. diam., in morabukea forest on ochreous-brown clay soil on hill slope; slightly buttressed; flowers creamy-white." Moraballi Creek, Essequibo River, Nov. 1929 (leaves only), *Sandwith* 570. Mazaruni River, Aug. 1926 (leaves only, from seedlings?), *Forestry Department* record no. 888.

Vernacular name (Arawak), " Morabukea."

Distr. Surinam.

The flowering material collected by Mr. T. A. W. Davis removes all doubt as to the position of this species in the genus *Mora*, and enables the above description to be drawn up. The characters of the inflorescence prove to be strikingly similar to those of *M. excelsa* in every detail, the only differences detected being in the calyx-lobes, which appear to be rather longer, and in the ovary, which is sessile or very nearly so, instead of very distinctly stipitate. The flowering spikes are uniformly short, but further collections may show that they can be longer; those of *M. excelsa* are known

to vary greatly in length. The flowers of the two species appear to be of the same colour.

Mr. Davis has kindly sent the following note on Morabukea :

" Morabukea is normally not quite so large a tree as Mora, the average height of mature trees being 127 ft. against 135 ft. in Mora, and the difference in girth is still more marked, very large specimens of Morabukea being far less common than they are of Mora. Apart from the leaves the colour of the bark is a good distinguishing character, for though the difference may not be very marked in a few cases, it is very distinctive in typical individuals. *M. Gonggrijpii* has brick red bark (where it is clean and newly exposed by the shedding of old bark) whilst that of Mora is ashy brown, or light ochreous brown in colour. Mora boles appear ashy grey whilst those of Morabukea are decidedly reddish. The blaze is not distinctive."

" Ecologically the two species are alike in being gregarious. Morabukea is characteristic of localities always free from inundation, whilst Mora typically grows in swampy localities, or on low-lying ground subject to periodical floods. *M. excelsa* is, however, quite commonly found growing on hill slopes, when the general composition of the forest is very similar to that of Mixed Forest. In typical Mora Forest the canopy is less dense than in Mixed Forest. Morabukea Forest is characterised by a very dense canopy—it gives heavier shade than any other common forest type in British Guiana—and heavy undergrowth due to a dense mass of seedlings which form a thicket. Its associates are the species characteristic of Mixed Forest, but it is normally far more strongly dominant than is Mora occupying a similar habitat. In typical Mora Forest seedlings are abundant, but they do not form thickets comparable in density with those of Morabukea regeneration. Neither Mora nor Morabukea Forest can be definitely associated with any particular type of soil."

Key to the British Guiana Species of Dimorphandra.

Leaflets not stellate-pubescent ; flowers in solitary or few, long (usually much exceeding 10 cm.) simple racemes or spikes ; calyx campanulate or cup-shaped; petals longer than the calyx (species of Section *Pocillum*) ;

Leaflets 3–5-jugate, large, not less than 5·8 cm. long or 2·5 cm. wide, usually much larger : petals conspicuously sericeous-pilose within ..... 1. *Davisii*

Leaflets multijugate, not reaching the lowest dimensions of *D. Davisii*, usually much smaller ; petals glabrous or nearly glabrous within :

Flowers sessile ; petals less than 4 mm. long.....2. *congestiflora*

Flowers pedicellate ; petals more than 4 mm. long :

Lower surface of leaflets, rhachis, branchlets and inflorescence, densely cupreous-pilose.....3. *cuprea*

Lower surface of leaflets glabrous or glabrescent ; rhachis, branchlets and inflorescence not cupreous-pilose :

Leaflets up to 10 pairs, rather large, 2·5–5·5 cm. long, 0·6–2·4 cm. wide.....4. *Hohenkerkii*

Leaflets numerous, more than 10 pairs, small, hardly up to 1·5 cm. long, very rarely exceeding 4 mm. in width.....5. *macrostachya*

Leaflets large, stellate-pubescent beneath ; flowers in numerous, short (usually less than 10 cm.), paniculate spikes ; calyx cylindric ; petals small, shorter than the calyx (species of Section *Eudimorphandra*).....6. *conjugata* (*latifolia*)

1. **Dimorphandra Davisii** *Sprague et Sandwith*, sp. nov. ; distinctissima, specierum adhuc cognitarum prope *D. vernicosam* Spruce ex Benth. tantum ponenda, ab illa forma foliolorum magnorum, petalis intus dense sericeo-pilosis longe abhorrens.

Arbor excelsa, in terra albo-arenosa crescens ; ramuli summi nigrescentes, glabrescentes, costati, lenticellati. *Folia* usque 33 cm. longa ; petiolus sparse pubescens, 5·5–6·5 cm. longus ; internodium rhacheos simile, 3–4·2 cm. longum ; pinnae 2-jugae, altera jugi superioris nonnunquam suppressa, petiolis 2–4 cm. longis, internodiis rhacheos 1–4 cm. longis, omnibus cinereo-pubescentibus ; petioluli 3·5–6 mm. longi, similiter induti ; foliola 3–5-juga, opposita vel fere opposita, ovata usque oblonga, apice abrupte breviter (3–7 mm.) acute acuminata, basi rotundata et leviter cordata vel obtusa ecordata vel etiam acuta cuneata, 5·8–15 cm. longa, 2·5–5·5 cm. lata, subcoriacea, supra nitidula glabra vel glabrescentia, subtus satis dense minute cinereo-pubescentia, utrinque subtiliter inconspicue reticulata, nervis primariis utroque costae latere circiter 12. *Inflorescentiae* densissime racemosae, racemis solitariis vel binis ubique praesertim superne ferrugineo-tomentosis vel pedunculo inferne tantum pubescente ; pedunculus 3·5–10 cm. longus, 3·5–4·5 mm. diametro ; pars florifera densissima, 10·5–17 cm. longa, circiter 2·5 cm. diametro ; pedicelli tomentosi ad 3 mm. longi. *Calyx* turbinato-campanulatus, extra sericeo-pubescens, lobis inclusis 4–5 mm. longus, apice ad 4 mm. latus ; lobi deltoideo-triangulares, obtusi, circiter 1 mm. longi, ad 1·75 mm. lati. *Petala* anguste obovato-spathulata, 7·75 mm. longa, ad 2·6 mm. lata, extra glabra, intus inferne glabra ceterum conspicue dense sericeo-pilosa. *Stamina* uniseriata, glabra, matura filamentis 6·5–7·5 mm. longis juventute apicem versus conspicue angustatis ; antherae oblongae, vix 2 mm. longae, 1 mm. latae. *Staminodia* libera, decidua, glabra, filamentis in alabastro 1–1·5 mm. longis, lamina foliacea crassa plus minusve triquetra elliptico-lanceolata, 2·75–3 mm. longa, vix 1 mm. lata, apice ananthera. *Ovarium* stipite styloque incluso anguste fusiforme, saepe leviter falcatum, saepe leviter falcatum, 7–7·5 mm. longum, ad 1 mm. latum, dense flavescenti-sericeo-pilosum, stipite indumento ovarii circiter 2·5 mm. longo, stylo brevi glabro vix 2 mm. longo ; ovula 5. *Legumen* rectum vel leviter falcatum, planum, coriaceum, marginibus incrassatis, glabrum, oblongum, 16–20 cm.

longum, 3·3–3·6 cm. latum, apice in acumen ad 1 cm. longum contractum, indehiscens, stipite 2–4·5 cm. longo.

British Guiana. Mazaruni-Kuribrong Divide, between Camps 9 and 10, fl. and fr., Nov. 1926, *Davis* in *Forestry Department* record no. 895 (type); a large tree on white sand hill. *Ibid.*, Camp 8, fr. and old fl., Oct. 1926, *Mackay* in *F.D.* no. 891.

A magnificent species, with no obvious affinities. Its discoverer, Mr. T. A. W. Davis, writes as follows: "The specimen was not measured, but was a large tree about 30 in. diameter and probably 120 ft. or more in height. The bark is grey with regular longitudinal fissures. The crown is light, and the leaves are rather pale green, those on young trees or epicormic shoots being very much larger than those from the crowns of mature trees. No. 891 is undoubtedly the same species as No. 895. Flowers white."

"The trees are very large, unbuttressed, with long somewhat tapering boles. The normal girth attained undoubtedly exceeds that of *Mora excelsa*, and the average height is at least 120 ft. They grow gregariously in association with *Eperua* and *Dicymbe corymbosa*. Arawak Indians asserted that where it was found the undergrowth consisted of species which commonly grow in Muri (*Houmiri*) scrub. It was found growing on white quartz sand only, and the dead leaf-layer was always thick, but not excessively so as in Dakama Forest (*D. conjugata*)."

2. **Dimorphandra congestiflora** *Sprague et Sandwith* sp. nov.; *D. campinarum* Ducke affinis, indumento foliolorum calycisque e descriptione distinguenda.

Arbor, sat excelsa, cortice laevi. *Folia* usque 35 cm. longa, petiolo, rhachi, pinnisque ubique breviter molliter ferrugineo-tomentosis; petiolus 4·5–9·5 cm. longus, 3–4·5 mm. diametro; internodia rhacheos 1·5–3·5 cm. longa; pinnae 3–8-jugae, 11–22 cm. longae, petiolis vulgo 7–8 mm. longis, internodiis rhacheos 6–9 mm. longis; foliola sessilia vel minutissime petiolulata, multijuga, 28–29-juga, opposita, anguste obovato-oblonga (vel oblonga), apice obtuse rotundata (vel levissime emarginata), basi truncata levissime cordata, 1·5–3·3 cm. longa, 4·5–7·5 mm. lata, inferiora nonnunquam minora, coriacea, margine revoluto, supra nitida prope basin atque secus costam sericeo-pubescentia ceterum glabrescentia costa canaliculato-impressa excepta evenia rugulosa, subtus ubique flavescenti-sericeo-pubescentia costa ferruginea valde prominente ceterum fere evenia vel nervis lateralibus obscuris vix elevatis. *Inflorescentiae* apicem ramulorum versus complures (saepius 4), spicatae; spicae longissimae, aurantiaco-rubrae, ubique velut ramuli molliter ferrugineo-tomentosae, pedunculo 2·5–4 cm. longo, 4–5 mm. diametro, parte florifera usque 32 cm. longa et 1·2 cm. diametro, floribus sessilibus densissime congestis; bracteae subulatae, circiter 1·5 mm. longae. *Calyx* perfecte cupularis, statu vivo flavus, siccitate extra ferrugineo-tomentosus, intus pubescens, lobis inclusis 2·5 mm. longus atque latus; lobi late rotundato-ovati vel

subsemicirculares, vix 0·7 mm. longi, ad 1·5 mm. lati. *Petala* aurantiaca, obovato-oblonga, ad 3·75 mm. longa, 2–2·5 mm. lata, extra dimidio inferiore sparse flavescenti-pubescentia ceterum glabra, intus fere glabra sed prope medium sparsissime pubescentia. *Stamina* 5 glabra; filamenta rubra, matura 3–3·5 mm. longa, 0·6 mm. lata, apice angustata; antherae aurantiacae, ovato-oblongae, vix 1·5 mm. longae, circiter 0·8 mm. (vix 1 mm.) latae. *Staminodia* libera, glabra, laminis deciduis; filamenta in alabastro circiter 1 mm. longa, flore maturo elongata tenuia ad 4 mm. longa; lamina rubra, petaloidea, plana, membranacea, obovata, 1·5 mm. longa, 0·5 mm. lata, apice anthera rudimentaria circiter 0·4 mm. longa 0·3 mm. lata coronata. *Ovarium* sessile, anguste ovoideo-ellipsoideum, densissime longe flavescenti-villosum, stylo incluso 3·25 mm. longum, 1 mm. latum; stylus brevis, glaber, vix 1 mm. longus; ovula 8. *Fructus* ignotus.

British Guiana. Mazaruni River: Macreba Falls, Kurupung River, August 1925, *Altson* 348 (type). " A large tree, 80 ft. high, by waterside on sandy soil. Bark smooth, exudes translucent-brown watery secretion. Flowering spikes borne in terminal clusters at the summit, usually 4 in a cluster; calyx yellow; corolla orange; filaments red; anthers orange; dilated staminodes red; whole spike appears orange-red. The bark is said to be used in the construction of ' woodskins '."

Potaro River: Waratuk Path, Oct. 1898, *Jenman* 7429.

Vernacular name (Acawai), " Hawakaiyek " (*fide* Altson).

A very close ally of this species is *D. macrostachya* Ducke, non Benth., see note under *D. macrostachya* Benth. *D. congestiflora* and its allies are characterised not only by their sessile flowers, but also by their cupular, rather than campanulate, calyx, and unusually short petals.

3. **Dimorphandra cuprea** *Sprague et Sandwith* sp. nov.; *D. velutinae* Ducke manifeste affinis, pinnis foliorum paucioribus, foliolis infra cupreo-pilosis nec pallide sericeo-pubescentibus, racemis angustioribus, rhachi pedicellis calycibusque indumento cupreo multo densius atque longius tomentosis, lamina staminodiorum breviore apice anthera rudimentaria coronata differt.

Arbor parva, patula, 6 m. alta, partibus novellis inflorescentiisque ubique insigniter dense cupreo-tomentosis; ramuli summi costato-sulcati, ad 5 mm. diametro. *Folia* usque 30 cm. longa; petiolus ut ramuli indumento supra descripto praeditus, 4·7 cm. longus; internodia rhacheos similiter induta, 1·5–2 cm. longa; pinnae 9–12-jugae, 5–11 cm. longae, petiolis 3–4 mm. longis rhachique indumento cupreo denso indutis, internodiis rhacheos circiter 3 mm. tantum longis; foliola sessilia, multijuga, 20–40-juga, opposita, anguste lineari-oblonga sed apicem versus paulum dilatata, apice rotundata, basi truncata rhachi adpressa, 0·5 (ima et summa)–1·2 cm. longa, 1–2 mm. lata, coriacea margine revoluto, supra nitida plumbea costa pilosa demum glabrescente excepta glabra costa

canaliculato-impressa ceterum evenia, subtus dense praesertim costa valde prominente cupreo-pilosa ceterum evenia. *Inflorescentiae* axillares, solitariae, racemosae, passim cupreo-tomentosae ; pedunculus circiter 10–12 cm. longus, ad 2·5 mm. diametro ; pars florifera 18–26 cm. longa, 1·5 cm. diametro, floribus in verticillis congestis dispositis ; pedicelli 2–3 mm. longi ; bracteae subulatae, circiter 2 mm. longae. *Calyx* campanulatus, lobis inclusis 3 mm. longus, 4 mm. latus, utrinque cupreo-tomentosus ; lobi late ovato-triangulares, obtusi, ad 0·75 mm. longi, 1·5–2 mm. lati. *Petala* glabra, obovato-spathulata, 6–7 mm. longa, 3 mm. lata. *Stamina* 5, glabra, filamentis 4 mm. longis apice angustatis ; antherae oblongo-ellipticae, ad 2·25 mm. longae, vix 1 mm. latae. *Staminodia* glabra, filamentis in alabastro circiter 1 mm. longis (in flore maturo elongatis) ; laminae deciduae, in alabastro insigniter cohaerentes, foliaceae, crassae, carnosae, ellipsoideae, ad 3·5 mm. longae, circiter 1·5 mm. latae, apice antheris rudimentariis minutis coronatae. *Ovarium* sessile, ovoideo-ellipsoideum, cum stylo ad 4·5 mm. longum, 1·5 mm. diametro, dense cupreo-villosum ; stylus glaber, vix 1 mm. longus ; ovula 9. *Fructus* ignotus.

British Guiana. Kaieteur Savannah, Potaro River, Sept.-Oct. 1881, *Jenman* 1030. " A spreading tree, 20 ft. high."

4. **Dimorphandra Hohenkerkii** *Sprague et Sandwith*, sp. nov. ; *D. vernicosae* Spruce ex Benth. affinis, pinnis foliorum 4–5-jugis, inflorescentiis longissimis differt ; *D. polyandra* R. Benoist valde affinis, staminibus fertilibus 8–10 statim distinguitur.

Arbor mediocris, in terra arenosa crescens ; ramuli summi circiter 8–9 mm. diametro, obtuse angulati, late sulcati, minute ferrugineo-pubescentes. *Folia* usque 18 cm. longa ; petiolus minute cinereo- et ferrugineo-pubescens, 2·5–4·5 cm. longus, 2–3·5 mm. diametro ; internodia rhacheos similiter induta, 1·5–4 cm. longa ; pinnae 4–5-jugae, similiter indutae, ad 11 cm. longae, petiolis ad 1·3 cm. longis, internodiis rhacheos 0·7–1·2 cm. longis ; foliola subsessilia, 7–10-juga, obovato-oblonga vel oblonga, apice truncata levissime emarginata vel obtusa rotundata, basi obliqua obtusa, brevissime petiolulata, 2·5–5·5 cm. longa, 0·6–2·4 cm. lata, coriacea, supra nitida siccitate plumbeo-purpurascentia semivernicosa, subtus opaca brunneo-rubra, supra glabra costa nervisque impressis obscuris, subtus costa saepius pubescente excepta glabra costa nervisque lateralibus prominentibus venulis inconspicuis mesophyllo dense minutissime punctulato. *Inflorescentiae* axillares, solitariae, racemosae, dense cinereo- et ferrugineo-pubescentes vel subtomentellae ; pedunculus 3–5 cm. longus, 4–5·5 mm. diametro ; pars florifera usque 38 cm. longa, 1·7–2 cm. diametro ; pedicelli circiter 2 mm. longi, ferrugineo-pubescentes ; bracteae subulatae, circiter 2 mm. longae. *Calyx* statu vivo aurantiacus, campanulatus, lobis inclusis 3 mm. longus, 3·25 mm. latus, extra sparse ferrugineo-pubescens, intus tubo satis dense flavo-sericeo-pubescente ceterum glabrescens ; lobi rotundato-ovati, ad 1·25 mm. longi, ad 1·5 mm.

lati. *Petala* rubra, glabra, obovato-spathulata, ad 6 mm. longa, 2·5 mm. lata. *Stamina* 5, glabra, filamentis circiter ad 2·5 mm. longis; antherae oblongae, ad 2·5 mm. longae, 1 mm. latae. *Staminodia* glabra, laminis inter se liberis sed cum petalis plus minusve cohaerentibus, filamentis 2·5 mm. longis; lamina clavato-spathulata, foliacea, carnosa, 1·5–2 mm. longa, 0·5 mm. lata, apice anthera rudimentaria coronata. *Ovarium* subsessile, ellipsoideum, ad 4·5 mm. longum, vix 1 mm. diametro, dense villosum; stylus glaber, brevissimus, haud 1 mm. longus. *Legumen* planum, crassum, 14 cm. longum, 6 cm. latum, glabrum, nigrum.

British Guiana. Ite Creek, Kuruabaru River, Demerara River, Sept. 1919, *Hohenkerk* in *Forestry Department* record no. 823 (type): "tree, 60 ft. high, on white sand on the edge of 'Muri' bush; flowers cherry to brick-red, with orange calyx." Ridge between Ewaropa and Mauri Creeks, Demerara River, Nov. 1919, *Hohenkerk* in *F.D.* no. 823A: "on white sand, in 'Muri' bush; flowers cherry to brick-red, with orange calyx."

The description of *D. polyandra* was based on material collected from a single tree. The species owed its name to a very remarkable character which distinguished it from all other members of the genus, the presence of a second whorl of fertile stamens in addition to the normal whorls of stamens and staminodes. Thus M. Benoist described the androecium as composed of 5 staminodes and 10 fertile stamens. The British Guiana material cited above had been provisionally identified as a new species, when it was discovered that it agreed well with the description of *D. polyandra* except for its androecium, which was normal. One of the type sheets of *D. polyandra* was accordingly borrowed from the Paris Herbarium, and this was found to agree well with the British Guiana sheets in most important respects, from foliage to the small details of floral dissection, except for its abnormal androecium. Two flowers of *Benoist* 138 were dissected, and in each instance the calyx and corolla were pentamerous, whereas the androecium whorls were tetramerous. Thus there were 4 staminodes and 2 whorls of 4 fertile stamens, the outer whorl being the shorter. On present evidence, the best course is to describe the British Guiana material as a distinct species; on the other hand, it seems quite possible that M. Benoist's tree bore unusual, abnormal, flowers with an additional whorl of fertile stamens, but it is to be hoped that further collections in French Guiana will throw light on the matter. It may be added that, under the International Rules of Nomenclature, should *D. polyandra* prove to represent a teratological state and to be indistinguishable as a species from the British Guiana tree, that name must be rejected in favour of *D. Hohenkerkii*.

5. **Dimorphandra macrostachya** *Benth.* in Hook. Journ. Bot. ii. 101 (1840), non Ducke in Arch. Jard. Bot. Rio de Janeiro, iv. 39, 40, 42 (1925).

Ramuli summi crassi, minute ferrugineo-pubescentes. *Folia* usque 24 cm. longa ; petiolus 1·2–2·2 cm. longus, velut internodia rhacheos pinnaeque minute ferrugineo-pubescens ; internodia rhacheos 0·8–2 cm. longa ; pinnae 6–12-jugae, 7–12 cm. longae, petiolis ad 5 mm. longis, internodiis rhacheos 4–5 mm. longis ; foliola sessilia, ut videtur 17–25-juga, oblonga, apice rotundata saepius subtruncata, basi obliqua truncata rhachi adpressa, 0·5 (summa vel ima)–1·5 cm. longa, 2·5–4 mm. lata, coriacea, supra nitida marginibus nonnunquam pilosulis exceptis glabra costa impressa excepta evenia, subtus opaca secus margines costamque pilosula (costa nonnunquam glabra) ceterum glabra costa prominente ceterum evenia vel nervis lateralibus inconspicue elevatis. *Inflorescentiae* racemosae, apice ramulorum 2–6, dense minute ferrugineo-pubescentes vel subtomentellae ; pedunculus ad 3 cm. longus, 4–6 mm. diametro ; pars florifera usque 25 cm. longa, 1·5–2 cm. diametro ; pedicelli 2–3 mm. longi. *Calyx* campanulatus, lobis inclusis ad 3·5 mm. longus, 4 mm. latus, extra sparse ferrugineo-pubescens, intus tubo ferrugineo-pubescente lobis fere glabris ; lobi rotundato-ovati, 0·75–1·25 mm. longi, ad 1·75 mm. lati, ciliati. *Petala* glabra, obovata, ad 5·7 mm. longa, 3 mm. lata. *Stamina* 5, glabra, filamentis 4–4·5 mm. longis ; antherae oblongae, 2 mm. longae, vix 1 mm. latae. *Staminodia* filamentis in flore maturo tenuibus glabris ad 4·5 mm. longis ; laminae delapsae, non visae. *Ovarium* sessile, ellipsoideum, stylo incluso ad 5 mm. longum, 1·5 mm. diametro, dense villosum ; stylus glaber, brevis, vix 1 mm. longus ; ovula 9. *Fructus* jam valde immaturus dense minute ferrugineo-tomentellus, pilis longis sparsis praesertim secus margines hic illic interspersis, stipite circiter ad 1 cm. longo.

British Guiana. Sandstone district of Roraima, *Robert Schomburgk* 1045 (type). Roraima district, fl. Nov., Dec., *Schomburgk* 635 (962B) ; Richard Schomburgk refers to this species in his Travels as one of the chief floral constituents of the slopes of Roraima, where it grows to a height of 5000 ft. on the edges of forest. Arapoo Valley, Roraima, Dec. 1884, *im Thurn* Set A no. 39.

D. macrostachya Benth. of Ducke in Arch. Jard. Bot. Rio de Janeiro, iv. 39, 40, 42 (1925) is represented at Kew by *Ducke* 20203, and is a totally different plant. Ducke was presumably misled by Bentham's original description, which describes the inflorescence as spicate, although mention is made of the very distinct pedicels. Ducke's plant differs from Bentham's, *inter alia*, in the thinner inflorescence with sessile flowers, the much smaller petals (only 3 mm. long), and the persistent lamina of the staminodes. *D. macrostachya* Ducke is, in fact, very closely allied to *D. congestiflora* Sprague et Sandwith described above both in foliage and floral characters, and examination of further material may prove it to be conspecific. It is apparently distinguished chiefly by the glabrescence of the lower surface of the leaflets.

6. **Dimorphandra conjugata** (*Splitg.*) *Sandwith*, comb. nov.—*Mora conjugata* Splitg. in Hoev. et De Vriese, Tijdschr. ix. 109 (1842). *Dimorphandra latifolia* Tul. in Arch. Mus. Par. iv. 189 (1844); Walp. Rep. v. 575 (1845–6); Benth. et Hook. fil. Gen. Plant. i. 587–8 (1865); Pulle, Enum. Pl. Surinam, 209 (1906); Ducke, l.c. 44.

Arbor parva, in locis arenosis crescens. *Folia* petiolo 3–10 cm. longo, rhachi, pinnis, omnibus stellato-pubescentibus; pinnae 1–2-jugae, petiolo 2–6 cm. longo, internodiis rhacheos 4–10 (vel ultra) cm. longis; foliola 1–3-juga, apice truncata vel rotundata vel brevissime cuspidata, basi cuneata vel obtusa vel rotundata et levissime cordata, 5–24 cm. longa, 4·2–15 cm. lata, supra glabra nitida, subtus sparse regulariter stellato-pubescentia, utrinque praesertim subtus perlaxe reticulata, nervis primariis lateralibus 8–11. *Inflorescentiae* spicatae in paniculis densis dispositae, ubique ferrugineo-pubescentes vel subtomentosae; spicae 4–10 cm. longae, circiter 1 cm. diametro, floribus sessilibus. *Calyx* cylindricus, 3·25 mm. longus, vix 2·5 mm. latus, extra ferrugineo-pubescens. *Petala* inclusa, satis anguste spathulata, 3 mm. longa, ad 1 mm. lata, extra sparse pilosa intus praesertim superne marginibusque flavescenti-villosa. *Stamina* 5, glabra, filamentis 3·5 mm. longis; antherae oblongae, 1·75 mm. longae, 0·8 mm. latae. *Staminodia* libera, glabra, filamentis 4 mm. longis; lamina obovato-elliptica, in filamentum abrupte transiens, carnosa, 1·5 mm. longa, 0·75 mm. lata, apice ananthera. *Ovarium* sessile, stylo incluso 4·5 mm. longum, vix 1·5 mm. diametro, dense villosum; stylus glaber, vix 1·5 mm. longus; ovula circiter 8. *Fructus* desideratur.

British Guiana. In sandy places by the railway near Rockstone, June 1910, *Stockdale* in Bot. Gard. Herb. 8778: tree, 7–8 ft. high, with white flowers. Dry sandhills east of Rockstone, July 1921, *Gleason* 748: spreading tree, 40 ft. high. Demerara River, May 1887, *Jenman* 3932.

Surinam. Without locality, *Splitgerber*, *Hostmann* 1007. Splitgerber (l.c.) notes that *Mora conjugata* grew "plentifully in sandy places near Joode Savanne, with *Licania crassifolia* Benth."

Vernacular name (Arawak), "Dakama" (*fide* Jenman and Davis).

LIV.—OITICICA (LICANIA RIGIDA).

J. H. Holland.

For some years past kernels under the name of "Oiticica" have been coming on to the markets of London and Liverpool, mostly in sample quantities, but occasionally in consignments of several tons imported from Brazil. For want of material it was never possible to name the tree with any certainty. Requests for herbarium specimens to importing firms who had submitted samples for identification always met with a courteous response, but usually resulted in failure to obtain proper specimens, or the sending of other

trees bearing the same or a similar common name. At the outset the oilseed in question was believed at Kew, and by various authors, to be a species of *Couepia* (Rosaceae), and *C. grandiflora* Benth. was suggested. The botanical source has also been attributed provisionally to *Pleragina umbrosissima* Arruda (Rosaceae), *Moquilea tomentosa* Benth (Rosaceae), and *Licania rigida* Benth. (Rosaceae). *Pleragina* in the Index Kewensis has been treated as a synonym of *Couepia*, whether correctly or not it is impossible to say, but the names quoted referred without doubt to kernels which to all outward appearances belonged to the same species.

Fruits of two distinct species sent in response to a circular letter for Oiticica issued by the Foreign Office on behalf of Kew proved to be (1) *Moquilea tomentosa* Benth. and (2) probably *Clarisia racemosa* Ruiz et Pav. (Urticaceae), both large trees of Brazil. The Brazilian name of the first is " Oytycera " and the fruit is called " Oyty " or " Oity." The latter tree is called " Oiti manso " and has an edible fruit called " Oiticuro." The kernels of *Moquilea tomentosa* do not contain oil and those of *Clarisia racemosa*, on a sample of the fruits received from Bahia submitted by the Director to the Imperial Institute for analysis, were found to yield only 1·7 per cent. of oil, in comparison with about 60 per cent. found in the true " Oiticica " kernels. Accordingly neither is held to be of commercial value as a source of oil.

Usually the name " Oiticica " has been that under which the seeds in question have been sent to Kew for identification, but samples have also been received at the Museum (in 1915) as " Brazilian " or " Hazel Nuts." The Ceara name is sometimes given in publications as " Oticia."

The specimens recently received from Ceara through the kind offices of H. M. Consul-General at Pernambuco have been found ample to admit of determining the tree as *Licania rigida* Benth. They agree with the type specimens in the herbarium, described under this name by Bentham in 1840 (see Hooker's Journal of Botany, ii. 220 : 1840), and collected by Gardner (No. 1592) in Ceara, whence the present material was also obtained. Bentham apparently did not see the fruits, since he does not describe them.

The tree is reported to grow to a height of 15 metres, native of the States of Rio Grande do Norte, Ceara and Piauhy in north-east Brazil, flowering towards September, and fruiting from December to March. The fruits, in shape mostly ovoid to ellipsoid, are single-seeded, with comparatively thin shells about 45 mm. long, 15 to 20 mm. in diameter at the middle, and reddish brown or somewhat green in colour. A kilogram contains approximately 240 fruits, of which about 70 per cent. is seed—which is easily separated —and 30 per cent. hull. The kernels have been found on various analyses (see the works referred to below) to contain from 60 to 65 per cent., or an average of 63 per cent. of oil. The habit of the tree as illustrated (1) resembles that of the Mango.

The industrial value of the oil has been thoroughly investigated, but the production at the present time appears to be of importance only in the States above mentioned, where the tree is indigenous and abundant. According to Dr. Henrique Paulo da Cunha Bahiana (1) the factory preparation of the oil was taken up in 1876 at Fortaleza (Ceara) but was discontinued after a short time on account of the disagreeable odour. During the Great War (1914–1918) the extraction was again started by a Company in Rio Grande do Norte; again in 1927 the firm of H. H. Sardinha at Rio de Janeiro, and later (1929) the firm of C. N. Pamplona & Co. in Fortaleza commenced the extraction of Oiticica oil on a large scale.

The native method of preparing the oil is simple. The seeds are taken out of the shells, crushed in a mortar and boiled in a pot of water for some hours. The top oily layer is then skimmed off and purified by treatment for some time with clean water. This oil is used locally for rheumatism and other medicinal purposes.

On a commercial scale the extraction of the oil in Rio de Janeiro and Fortaleza is described (1) and the following facts have been abstracted from this account.

In the factory of J. A. Sardinha the seeds (or kernels) are conveyed by means of elevators to rotating sieves in order to separate impurities, and from these to roller presses where the seeds are broken but not crushed. They are then heated in a heater to about 70°C., crushed, and the oil is finally refined and rendered odourless.

The yield of oil is from 35 per cent. to 40 per cent. of the kernels. With this equipment it is possible to produce about 500 kg. of oil daily, though the actual production may be less. The price is lower than that of Linseed oil. The Sardinha factory aims at treatment that will considerably or completely remove the unpleasant odour of the oil. Experiments are in progress to make the oil permanently liquid.

The Myrian Factory in Fortaleza (Ceara) was established in 1928 by Carlito N. Pamplona and Franklin Monteiro Gondim. As Oiticica seeds were not available in sufficient quantity when the factory was erected (April 1929), castor oil was produced during the latter part of that year. Oiticica oil was first produced in January 1930, nuts having begun to come in from the new harvest in December 1929.

The procedure is the same as in Sardinha's factory, but the capacity of the machines is greater. The oil is despatched in tin plate receptacles of 15 kg. or more, often in iron drums. The factory is concerned entirely with the production of oil at present, but the production of paints and varnish has been under consideration. The entire production is exported from the ports of Sao Paulo and Rio de Janeiro. The new industry in Ceara is being assisted by the State in that it is to be exempt from taxes and duties for the first ten years. Felling of Oiticica trees has been prohibited and they are included in the State estimates of trees.

The kernels have been examined by Bolton and Revis (2), and at the Imperial Institute in 1929 (4). The former analysis was made according to the authors in the early part of 1917, when they stated that the oilseed had been sent apparently for the first time from Brazil, bearing the native name " Oiticica " or " Oilizika."

The description given by them mentions the characteristic odour, which, as above stated, was sufficiently powerful to stop the extraction on a large scale in Ceara. " They have a peculiar and very distinctive smell, which might be described as a heavy and overpowering odour, rather recalling the smell of tung oil, a very interesting property, seeing that the oil, as subsequently described, bears a distinct resemblance to tung oil."

The outstanding features of the oil were given as follows :— " Melting-point.—As the oil consists of a mixture of oils varying from liquids to hard solids no definite figures can be given to represent the melting-point of the oil, and the points of incipient and complete fusion must both be considered—incipient fusion, 21·5°C., complete fusion 65·09°C. Iodine Value, 179·5 ; Saponification Value, 188·6 ; Free Fatty Acids as oleic, 5·7 per cent. ; Unsaponifiable matter, 0·91 per cent. ; Sp. Gr. at 15·5/15·5°C., 0·9694 ; Refractive Index at 40°C. Zeiss, beyond the scale of the Zeiss butyro-refractometer."

A series of chemical experiments is recorded by these authors, who state that " all tended to show that this oil has very remarkable properties, which place it in a distinctly unique position and there seems every reason to suppose that the oil is worthy of the attention of the varnish-maker and possibly also of those interested in the manufacture of linoleum, but for these purposes it will be necessary to obtain the oil on a commercial scale."

The above analysis is recorded (4) with others made at the Imperial Institute. One of these analyses of the oil, extracted from imported kernels, showed the constants to be Specific Gravity at 15/15°C. = 0·9673 ; Refractive Index at 40°C., 1·507 ; Acid value 5·6 ; Saponification Value 186·1 ; Iodine Value (Wijs, 3 hrs.) per cent. 144·8; Unsaponifiable matter per cent. 0·9 ; and Solidifying point of fatty acids 45·4°C. In general the examination showed that " the kernels examined contained a normal percentage of oil of the usual appearance. . . . A comparison of the figures with those recorded by Bolton and Revis shows that the solidifying point of the fatty acids of the oils examined at the Imperial Institute was from 2 to 4·6 degrees above that previously recorded whilst the Iodine Value of the oils is about 35–40 per cent. below the recorded figure." The oil in this analysis was also found to resemble Tung oil.

Similar characteristics of the oil are recorded (7) in a recent paper by Dr. Jordan, who summarises the results of investigations, which have been made as follows :—" From the tabulated records it will be seen that the physical as well as the chemical properties of the oil samples vary widely. This variation is undoubtedly due to the high

acidity and rapid oxygen absorption to which reference has already been made—for example . . . a drop of 15 points in iodine value between cold pressed and hot pressed oil from the same seed is quite outstanding. There is also no doubt about the fact that the variations reported as to the capacity of the oil to gelate are really due to variations in acidity, which in some samples must have been sufficient practically to inhibit gelation altogether.

Making allowances for these variations it is concluded that oiticica oil is characteristic in respect of :

(*a*) smell, which is very persistent ;
(*b*) density, which is higher than that of tung oil ;
(*c*) refractive index, which is lower than that of tung oil ;
(*d*) melting point range, which shows a great difference between incipient and complete fusion ;
(*e*) heat polymerisation and gelation, rather slower than tung oil ;
(*f*) high oxygen absorption, relative to linseed oil."

Other analyses could be given—Van Loon and Steger (Delft, Holland), Grimme (German), Gardner (United States), etc.—but that first recorded (1918) and the most recent (1929) of imported kernels will perhaps be sufficient to give an idea of the general characters of the oil.

Whether it will ever prove an effective substitute for Tung oil (*Aleurites Fordii*) seems open to question. There are no export figures available either of kernels or of oil from the country of origin to show that the trade has become of any commercial importance outside Brazil.*

There is no information available on the rate of development of *Licania rigida* under cultivation, but when mature it is said to yield fruits abundantly and it would no doubt prove to be a good shade tree in parks or avenues.

From the experience at Kew the germination of the seeds seems to be very uncertain. Out of 60 sown on April 25th only one showed signs of germination on July 6th, or about three months from the time of sowing. They were selected from the fruits received from Ceara with the herbarium material mentioned above and all appeared to be comparatively fresh when sown. Some seeds (kernels of the trade) were sent to Kew for identification in March 1924 by Messrs. Kleinwort, Sons & Co., of Liverpool, and of two seeds selected for growing at the propagating pits one germinated in less than a month

*In a paper on "Le Commerce des graines oléagineuses au Brésil... L'Oiticica..." in Bulletin des Matières grasses de l'institut Colonial de Marseille, no. 2, 63 (1931), it is stated that the export of this oil dated only from that year ; it had been, up to May, approximately 25,500 kg. in all.

In a monograph on Tung Oil, by C. Concannon (U.S. Dept. of Commerce), Trade Prom. Ser. No. 133, 59 (1932), it is estimated that "only small quantities have been shipped to foreign countries, but the development of an export trade in Oiticica Oil is hoped for, and trial shipments have recently been made to Germany, England, Belgium and the United States."

after sowing. On the other hand the seeds of *Moquilea tomentosa* germinate readily. In a small consignment of fruits received from the British Consul at Para in 1929, the seeds germinated freely and there are now several well-established plants about 3 ft. high.

LITERATURE.

(1) "O Oleo de Oiticica e as vantagens de sua industria no Brasil." Dr. Henrique Paulo da Cunha Bahiana in Boletim do Ministeres da Agricultura, Industria e Commercio, Rio de Janeiro, Sept. 1930, 443–460. (Under the name of "*Licania rigida*".)

(2) "Oiticica Oil—a New Drying Oil," E. Richards Bolton and Cecil Revis in "The Analyst," July 1918, 251–253. Reprint in American Journal of Pharmacy, October 1918, 727–730.

(3) "Oticia or Oiticica Oil." Bull. Imp. Inst. 1923, 641.

(4) "Oiticica Nuts (*Licania rigida*)." Bull. Imp. Inst. 1929, 279.

(5) "Oticia Oil: A possible Adjunct to Tung Oil." Henry A. Gardner, Circular 177, Educational Bureau, Paint Manufacturers Association U.S.A. 1923.

(6) "Das Oiticica-Ol und die Oiticica-Olindustrie in Brasilien." Der Tropenpflanzer, Berlin, May 1931, 206–210.

(7) "Oiticica Oil," Dr. Jordan in Technical Paper of the Research Association of British Paint, Colour and Varnish Manufacturers, No. 34, 155–158 (1932).

LV.—MISCELLANEOUS NOTES.

Hooker's Icones Plantarum.*—Part iii. of vol. ii. of the Fifth Series, which has now appeared, includes descriptions and plates of sixteen new or recently described species of special interest, four of them belonging to genera not previously or adequately figured. The remaining nine plates illustrate little-known species or varieties.

Delphinium (*Consolida*) *acutilobum* Turrill (t. 3151) is a native of northern Persia, discovered by Mr. Gilliat-Smith in 1927. *D. macedonicum* Halácsy et Charrel (t. 3152) is a very beautiful species of larkspur inhabiting Thrace, Anatolia and Armenia. Its rather complicated history and synonymy have now been elucidated. *Tamarix Hampeana* var. *aegaea* Turrill (t. 3153) is a new variety, from W. Thrace. It is remarkable for the long acuminate bracts and might have been treated as a distinct species but for the existence of specimens intermediate in character. *Genista tinctoria* var. *virgata* Koch (t. 3154), which is distributed in Central and South-Eastern Europe, differs from *G. tinctoria*, as represented in Western

*Hooker's Icones Plantarum; or, figures, with descriptive characters and remarks, of new and rare plants, selected from the Kew Herbarium. Fifth Series. Edited for the Bentham Trustees by Sir A. W. Hill, K.C.M.G., Sc.D., F.R.S., Director, Royal Botanic Gardens, Kew. Vol. ii. part iii. (London, Dulau & Co., 1932). Price 10*s*.

Europe, by its tall erect habit (up to 2 m. high) and numerous slender twigs, as well as by its persistent stipules. *Cotyledon lassithiensis* Hayek (t. 3155) is a native of Crete and Thrace, described by the late Dr. Hayek in 1925. It differs from *C. pendulinus* Batt. chiefly in its coarsely serrate bracts. *Onopordon tauricum* Willd. (t. 3156) is a handsome thistle figured from material grown at Kew from Bulgarian seed. It has a wide distribution in South-Eastern Europe and N. Asia Minor, but its occurrence in the western Mediterranean as a native plant is doubtful. *Sideritis scardica* Griseb. (t. 3157) is collected in considerable quantity in Bulgarian Macedonia, and is used for making an infusion which is drunk as " tea."

Neocheiropteris Waltoni Ching (t. 3158) is a second species of a genus of Polypodiaceae hitherto supposed to be monotypic. It is a native of Tibet, and differs from the Yunnanese *N. palmatopedata* (Baker) Christ chiefly in its hastately trilobed fronds. *Sloanea elegans* Chun (t. 3159) and *Acer sycopseoides* Chun (t. 3160) are new species from South China. The latter is remarkable, in the genus *Acer*, for its undivided or slightly trilobed leaves. *Pterostyrax Leveillei* (Fedde) Chun (t. 3161) is clearly allied to *P. hispidus* Sieb. et Zucc., from which it may be distinguished by the tricuspidate leaves and floral characters. *Gentiana setulifolia* Marquand (t. 3162), from S.E. Tibet, is unique in the genus in having ciliate leaves and calyx-lobes. *Kingdon-Wardia* is a recently described monotypic genus, intermediate between *Gentiana* and *Swertia*. *K. codonopsidoides* Marquand (t. 3163) has been found only in S.E. Tibet. *Buddleja gynandra* Marquand (t. 3164), which is a native of Tonkin, differs from all previously known species of *Buddleja* in the position of the stamens, which are semi-epigynous instead of being attached to the corolla-tube. *Leycesteria crocothyrsos* Airy-Shaw (t. 3165), from Assam, is a beautiful new species with foliaceous stipules and orange flowers. *L. gracilis* (Kurz) Airy-Shaw (t. 3166) has a wide distribution in Sikkim, Bhutan, and Yunnan. It was long known erroneously under the name *L. glaucophylla* (Hook. f. et Thoms.) Hook. f. That species is now assigned to subgen. *Euleycesteria* Sect. *Pentapyxis*, whereas *L. gracilis* is the type of a new subgenus, *Paralestera*, distinguished by the 8-locular glabrous ovary and very small subulate bracts. *Taraktogenos calophylla* Ridley (t. 3167) is a new species from Sarawak.

Paraphyadanthe suffruticosa Milne-Redhead (t. 3168), a new species from Northern Rhodesia, is an undershrub, well adapted to withstand savannah conditions and especially the annual grass fires which sweep the country at the end of the dry season. *Paraphyadanthe* belongs to the Flacourtiaceae-Oncobeae. *Dalbergiella nyasae* E. G. Baker (t. 3169), a tree originally described from Nyasaland, is by no means uncommon in Northern Rhodesia, though it was not collected there before 1929. The fruits possess a remarkable fringe of plumose hairs along the dorsal suture. The genus, which was described for the first time in 1928, belongs to the Leguminosae-

Dalbergieae. *Canthium Gueinzii* Sond. (t. 3170) has a wide distribution from Uganda and Kenya Colony in the north to the Transvaal, Natal and Zululand in the south. It is readily distinguished from all other species of *Canthium* by the reddish tomentum of the young branchlets and by the lateral nerves being impressed in the glabrous upper surfaces of the mature leaves. Perhaps the most remarkable plant in the Part is *Rhopalota aphylla* N. E. Brown (t. 3171), a diminutive aquatic member of the Crassulaceae, which has been segregated generically from *Crassula* chiefly on account of its leafless stems and truncate-convex uniovulate carpels. The flowers are sunk in the upper surface of the club-shaped segments of the stem, so that the limits of calyx and stem-segments are difficult to distinguish.

Barnhartia floribunda Gleason (t. 3172), from British Guiana and the Amazons, was described in 1926 as a new genus and species related to the Styracaceae. It is shown that both *Barnhartia* and the related genus *Diclidanthera* (on which a new family, Diclidantheraceae, was based in 1924) should be referred to the Polygalaceae. The Part ends with three species of *Strychnos* from British Guiana. *S.* (§ *Longiflorae*) *diaboli* Sandwith (t. 3173) is a new species known by the Arawak Indians of British Guiana as " Black Devil-Doer " on account of its poisonous properties. *S.* (§*Intermediae*) *Melinoniana* Baill. (t. 3174) is known, for a similar reason, by the vernacular name " White Devil-Doer." *S.* (§*Longiflorae*) *tomentosa* Benth. (t. 3175) is related to *S. toxifera* Rob. Schomb., from which it differs in the indumentum of the branchlets and leaves and the shape of the calyx segments.

Principles of Soil Microbiology.* The investigation of the activities of micro-organisms occurring in the soil is to-day one of the most important and far-reaching problems of agricultural science. Since the publication of the first edition of Waksman's Principles of Soil Microbiology (see *K.B.* 1927, 424) there has appeared a considerable volume of new literature on the subject. In this second edition the author has incorporated much additional recent information. Certain chapters, as for instance that on mycorrhiza, have been entirely rewritten, and some new chapters have been added dealing with the decomposition of organic matter in natural and artificial manures, with the transformation of organic matter in peat and forest soils, and with the relation between plant growth and the activities of soil micro-organisms. To counterbalance the increase in size of the work which would have resulted, there has been some condensation by the omission of not strictly relevant matter and by the combination of certain chapters. The resulting volume actually has three pages less than the first edition, and 15

*Principles of Soil Microbiology, by Selman A. Waksman. Second Edition. Baillière, Tindall & Cox, 8, Henrietta Street, Covent Garden, London, W.C. 2, 1931, pp. xxviii + 894, 15 plates, 83 figures in text, price 52*s.* 6*d.*

instead of 19 plates. Allowing for a few more text-figures and an additional number of words, it is still difficult to see why it was necessary to raise the price from 45/- to 52/6. The work is of the first importance, not only to investigators in soil science, but also to advanced students of general biology. It is unfortunate therefore that its price could not have been brought more within the means of the average research worker.

E.M.W.

The Curious Gardener.*—Mr. Jason Hill has rendered a conspicuous service to Horticulture in this book, since he reminds us of many interesting and valuable old garden plants, which are tending to vanish or have vanished from our gardens owing to the desire for new forms.

Many of the old-fashioned flowers charmed us by their scent or some other pleasant qualities, such as beauty of form, now often ousted by doubling and so on. The author reminds us of the old-fashioned roses, now so largely neglected, which it is hoped will again receive attention thanks to his welcome volume. If Mr. Hill would look through the early numbers of the Botanical Magazine and try to reintroduce the numerous plants of interest now lost to cultivation he would perform a signal service to horticulture and good gardening.

His chapter " The Invisible Garden " is one to be commended, since he dilates there on those plants which yield their fragrance to us either from their leaves or flowers. How much pleasure can be derived from scented plants is not fully appreciated by those whose main delight is to cultivate plants only for the size or brilliance of their flowers.

A number of plants are mentioned all of which are worthy of a place in any garden, and which could well be grown apart in a separate plot.

The book is illustrated with some interesting drawings by John Nash, and in all the chapters there are references to plants well worthy of attention by the " Curious " amateur gardener, who should take the interest of a connoisseur in his garden.

Insects and Diseases of Ornamental Trees and Shrubs.†—Although primarily a book for the guidance of those interested in American Arboriculture, this important work is also applicable to this and other European countries, for many of the fungus diseases

*By Jason Hill, London, Faber & Faber, Ltd., 24, Russell Square, pp. 173, ill. 7. Price 7*s.* 6*d.*

†By Ephraim Porter Felt, Director and Chief Entomologist, Bartlett Tree Research Laboratories; and W. Howard Rankin, Associate in Research in Plant Pathology, New York State Agricultural Experiment Station, Cornell University. Published by the Macmillan Company, New York and London, 1932, pp. xix + 507, 243 text figures. Price 25*s.* net. Obtainable in this country from Messrs. Macmillan & Co., Ltd., London.

and insect pests considered are troublesome alike to North American and European cultivators, whilst similar means of control are necessary wherever they are found. The book, which is divided into two parts, commences with a general description of insects, their life history, and depredations. This covers pp. 3–38 and includes notes on the anatomy of insects, the transformation stages of various kinds, food preferences, methods of attack, natural checks to injurious insects, climatic effects on insects, the more important groups injurious to shade trees, and other subjects. Lists are then given of borers and wood-gnawers, leaf-feeders, sucking and other insects.

Chapter 2 deals in like manner with fungi and extends from p. 39 to p. 99. General remarks on fungi are followed by sections on their methods of causing disease, descriptions of specific types of disease, and the treatment of wounds and cavities. The next eleven pages deal with the composition and methods of use of a considerable number of insecticides and fungicides, and a chapter follows on injuries other than those caused by organisms.

Of particular interest to persons residing in or about industrial towns are the pages on gas and smoke injuries. Lists are given of some of the most easily affected and of some of the most resistant trees. From the former list the horse chestnut is missing. That tree is one of the first deciduous trees to suffer from impure atmospheric conditions in this country. The ash heads the list of resistant trees, a decision that is corroborated by experience in the British Isles. This concludes Part I of the book.

Part II is devoted to an alphabetical arrangement of trees and shrubs with accounts of the associated insects and fungi. In this the various groups of trees and shrubs are taken in alphabetical sequence under their common names. The various pests and diseases peculiar to each genus are dealt with at varying lengths according to their bearing upon the health of their hosts, one that occasions little harm being dismissed in a few lines whereas one or more pages may be devoted to those that are of greater virulence and endanger health and life. In the latter cases methods of control are described. The book is concluded by a good index. W. D.

A Handbook of Empire Timbers.*—In the preface we are informed that the object of this book is to direct the attention of architects, engineers, builders, the designers and makers of furniture, and other people interested in the use of timber, to a number of the more important woods of the British Empire, and ways are indicated whereby they may be used instead of those of foreign origin. The Imperial Institute, the Forest Products Research Laboratory at Princes Risborough, the Royal Botanic Gardens, Kew, and the

*A Handbook of Empire Timbers. Issued by the Empire Marketing Board, 2, Queen Anne's Gate Buildings, London, S.W.1, pp. 102. Particulars from the Secretary.

Empire Marketing Board have collaborated in the production of the book and the Empire Marketing Board has undertaken the important work of publication.

The timbers described are limited to sixty, and include only those of proved worth of which a regular supply can be maintained. They are geographically arranged, and under the general heading of the trade name each timber is described under several subheads. The first paragraph in each description deals with the scientific name of the tree, its average size and general distribution. Then are given descriptions of the physical properties of the timber, mechanical properties, seasoning, durability, working and finishing qualities, sizes as generally available, and its principal uses, in fact, all the particulars that are required by a person who is asked to use a particular wood of which he has no previous knowledge.

The various woods described have been well tested, and lists of their special uses are given on pp. 94–96. Specimens of all of them are to be seen in the museums in the Royal Botanic Gardens, Kew. The use of the book is facilitated by a good index of scientific and common names, and it should be included in the library of every person interested in the marketing and use of timber. W. D.

The Birds of Tropical West Africa.*—The first volume of this valuable work, including an introductory essay on the relationship of the vegetation belts to the distribution of bird life in tropical Africa, was reviewed in *Kew Bull.* 1930, 334. The second volume, which appeared late in 1931, continues the systematic description of genera and species and includes the Orders Ralliformes (Rails and Finfoots), Gruiformes (Cranes, Bustards, Stone Curlews, and Lily Trotters), Charadriiformes (Waders), Columbiformes (Sandgrouse, Button-Quails, Pigeons and Doves), and Psittaciformes (Parrots).

Under each species or variety are paragraphs dealing with its synonymy, technical description, field identification, range and local distribution, and habits, the last section being attractively written and containing many facts of interest to the general reader. No support is given to the popular belief that the Egyptian Plover or Crocodile Bird enters the mouth of the Crocodile in order to pick its teeth. The coloured illustrations of the commoner birds are particularly good. The volume also contains a useful map of the Gold Coast on which the railways, roads of various classes, and principal paths are clearly marked.

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*By D. A. Bannerman. The Crown Agents for the Colonies, 4, Millbank, Westminster, 1931, pp. xxx + 428, full page plates 15, coloured map, text figs. 114. Price 22*s.* 6*d.*

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